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Investigation into Animal Ill Thrift on Rotomahana "Mud" Country ...... C. R. Taylor and A. G. W. Stevens 546
Making the Best Use of Pig Housing ...... E. D. Edwards 551
Radio Broadcasts 555
Care of Livestock during January 556
Seasonal Notes 557
Grass Staggers in Beef Cattle ...... E. H. Shortridge 559
Wilt-resistant Onward Peas ...... D. E. Yen and R. J. Casey 565
A. and P. Show Dates, Wool Sales, Ram and Ewe Fairs 566
The Business Side of Farming ...... H. H. Turnbull 567
Transference of Fertility on Rolling Country ...... A. V. Allo 571
Tripod for Weighing Stock ...... B. A. J. Smith 573
Celery Varieties Treated with Gibberellic Acid ...... A. B. Webster 575
Turnips as Winter Feed for Hoggets ...... K. H. C. Lewis 577
Meteorological Records for October 580
Vegetable Production: Beans 581
Studies in Farm Management: A Waimarino Fat Lamb Farm ...... A. A. Duncan 593
Round the Research Stations 604
Home-made Liquid Feeds for Trickle-irrigated Glasshouse Tomatoes ...... A. B. Webster and W. R. Boyce 607
Dairy Produce Graded for Export 612
Crop Production: Carrots ...... A. C. Burgess 613
Inoculation and Pelleting of Clover Seed ...... A. Hastings and A. D. Drake 619
Recent Research Work ...... F. C. C. Hupkens van der Elst 623
Facial Eczema ...... J. F. Filmer 624
Christmas Time ...... Betty Johnston 632

The Flower Garden:

  Indoor Plants ...... J. S. Say 637
  Garden Work for January ...... Joy Watkins 641
Be Careful with Insecticides ...... Janet W. Roberts 645
Index to Volume 101 646

Tom looks as fresh as a daisy as he faces up to the start of the gastronomic marathon that is still the traditional Christmas dinner in many New Zealand homes. Further laps in the Gourmet's Galop, and tips on how Tom's wife can prepare such fare and still preserve enough vitality to take part in its demolition, are given on page 632.

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Investigation into Animal Ill Thrift on Rotomahana "Mud" Country, Rotorua

SOON after settlement some seven years ago of the Rotomahana-Rerewhakaaitu district, an area of about 22,000 acres developed by the Department of Lands and Survey since the war largely for rehabilitating ex-servicemen, an animal ill thrift problem developed. There was intense scouring in young stock, high mortality in calves between weaning and yearlings, and some scouring accompanied by low production from mature dairy cows.

By C. R. TAYLOR,
Instructor in Agriculture,
and
A. G. W. STEVENS,
Livestock Instructor,
both of the Department of
Agriculture, Rotorua

BEFORE subdivision of the block into 140- to 160-acre dairy farms the Department of Lands and Survey had farmed it with sheep and run cattle for some years. Probably because stock were changed frequently round the area and even on to adjacent blocks, not a great deal of ill thrift was noted. Only when stock finally became closely confined, as on a dairy farm, was a problem manifest, and then it was more evident in calves and young animals than in mature cattle, the effect on mature cattle being more noticeable in low production and some scouring.

Unlike the volcanic country usually selected for large-scale development and settlement in the Rotorua-Taupo region (products of the Taupo and Kaharoa ash showers), the soil types of the Rotomahana - Rerewhakaaitu district are substantially influenced by the eruption of Mt. Tarawera in 1886.

Two quite distinct types of soil forming material are involved; one, known as Rotomahana "mud", was ejected from lowland craters during the later stages of the Tarawera eruption and the other, covering a much larger area, was discharged from several craters on the mountain itself.

The common description mud indicates that this soil type is relatively fine textured for volcanic soil, tending to poach in winter and crack in summer. Nevertheless, it is capable of carrying excellent ryegrass-white clover pastures after normal treatment with phosphate fertilisers. It is relatively high in available calcium (lime), potash, and molybdenum, the last element being present at a level several times higher than is general in what is referred to as the Rotorua-Taupo pumice.

The second soil type, often broadly described as Tarawera gravel on account of its coarse, open texture, is a free-draining, droughty type which is more suited to the growth of cocksfoot and red clover than ryegrass and white clover, especially in the early years after development. As with the mud country, Tarawera gravel responds well to superphosphate and does not appear to be lime or potash

← Part of Rerewhakaaitu district with Mt. Tarawera in background. It is undulating to gently rolling and the soil is mainly Rotomahana "mud" with some Tarawera gravel. The country is excellent for ryegrass-white clover pastures and is capable of high carrying capacity and production.

Soil profile showing mantle of → Rotomahana "mud" (grey layer on top) resulting from eruption of Mt. Tarawera in 1886. The darker pumice immediately below the mud is the product of the Taupo ash shower, a material which covers several million acres and is substantially associated with large-scale land development projects in the Rotorua-Taupo region.

deficient to start with, but later tends to a potash deficiency, especially after some haying of an area. Molybdenum levels are not as high as recorded for Rotomahana mud, but are higher than is usual in ordinary pumice soils.

Since Rotomahana sandy loam (mud) gave rise to more intense animal ill thrift than Tarawera gravel, it was decided, after a settlers' meeting, to set up a committee of representatives of the Departments of Agriculture and Lands and Survey and the State Advances Corporation to reach an agreement with a mud country farmer for the use of his property and stock for experiments for three or four years.

The farmer was to continue managing the property under the direction of the Department of Agriculture, while the State Advances Corporation was to see that he was not placed at a financial disadvantage as the result of his cooperation with the committee. Mr I. R. Merrett of Rotomahana was selected.

Dr I. J. Cunningham, then Superintendent of the Department of Agriculture Wallaceville Animal Research Station (now Assistant Director-General of Agriculture), was in charge of the experimental programme. In discussing with settlers and members of the committee likely causes of the problem Dr Cunningham gave high priority to the following possibilities:

1. Existence of a slight cobalt deficiency even though the mud country had always been regarded as free from bush sickness.
2. A level of pasture molybdenum high enough to be toxic to stock.
3. Insufficient pasture copper to counteract the known relatively high level of molybdenum.
4. Special problems incidental to pasture control and management (lack of subdivision, insufficient numbers of stock, etc.) affecting the adequate nutritional requirements of animals.
5. A combination of all the above factors.

Experimental work to occupy at least three years was planned along these lines. An additional trial with selenium administered to calves extended the programme into a fourth year.

In regard to 4 above, Dr Cunningham felt, from the beginning that much of the trouble could be due to the inability of settlers in their first year or two to develop their pastures quickly into well balanced units of grasses and clovers and to maintain adequate control over their growth.

Insufficient subdivision and too few stock at settlement produced a dense, smothering growth of clovers, particularly red clover and cocksfoot, which adversely affected the development of ryegrass, timothy, and crested dogstail originally sown in the seeds mixture. Thus animals had to subsist on an ill-balanced diet of certain pasture species for rather too long to ensure their good health and production. In such circumstances, especially with the high rainfall of this area, it was also not unlikely that internal parasites would play at least some part in the problem. That these views were substantially correct is clearly demonstrated by the results of the experiments.

EXPERIMENTAL WORK

1956-57

Because much of the stock health problem was believed to be associated with the lack of subdivision to control pasture growth and ensure that the nutritional requirements of the animal were fully provided, the erection of additional internal fencing was immediately considered.

In the first year (1956-57) on this 137-acre dairy farm the number of paddocks was increased from eight to 19 and the acreage of pasture was increased from 68 to 93 by developing and grassing 25 acres of fern and manuka country.

Water reticulation was taken in hand as part of the subdivision programme.

In addition to the 93 acres of pasture there was also an excellent stand of young lucerne of about 8½ acres, making 101½ effective acres in all at the end of the first year. As this work took most of the first year to complete, the advantages from it were not secured until the second and subsequent seasons, as shown by carrying capacity and production figures referred to later.

In addition to the permanent improvements mentioned above a trial was started with cobalt. Sixteen calves were separated at birth into two groups of eight and one group treated weekly with 35 mg of cobalt, the other being untreated as a control. All calves were run together and in all other ways treated alike. Growth rate data were provided by monthly weighings that were continued until weaning at about 250 lb body weight. During this trial no cobaltised top-dressing was used on the farm.

Results

There was a very slight but not significant difference in favour of the

▲ Part of Mr I. R. Merrett's farm at Rotomahana, showing contour of the land and a section of his dairy herd. The soil type is almost pure "mud" and capable of at least 280 to 300 lb of butterfat per acre.

cobalt treated group. Therefore no advantage could be attributed to the feeding of cobalt. All calves, apart from two in the control group which died of bloat in April 1957, developed normally and later grew into fine yearlings and milking heifers.

As it became increasingly apparent early in 1957 that the cobalt treated calves were not likely to improve materially on the untreated controls, it was decided to apply a still more sensitive test for cobalt deficiency in livestock.

Twenty-four wether lambs from a known cobalt deficient area (Kaharoa) were bought and transferred to the experimental farm. They were divided into two groups of 12, one being treated weekly with 7 mg of cobalt, and the other being untreated as controls. All lambs were run together and otherwise treated alike. Weighing at about monthly intervals continued from 24 January to 29 July 1957.

A slight but not significant liveweight increase favoured the feeding of cobalt, as was the case with the calves. It was, therefore, concluded that the lamb trial showed that there was no cobalt deficiency on the experimental area. This finding finally confirmed that little or nothing could be expected from cobalt in the problem under investigation.

1957-58

Attention was then given to the possible role copper might play in overcoming scouring and general ill thrift in stock; pasture samples collected from several paddocks during the first year at more or less monthly intervals had revealed consistently high levels of molybdenum in relation to available copper.

Because copper topdressed as bluestone on pastures was shown to have had a very limited life in the tissues of pastures (plant uptake was rapid but increased levels were maintained for short periods only) and was an expensive method of administration, it was decided, for the second year's project, to divide 14 calves weighed at birth into two groups of seven, giving one group an injection of copper cerate (½ tube each) in July and again in December 1957, leaving the other untreated as a control.

Except for the copper cerate injections all calves were run together and treated similarly until April 1958, when, after a break in a prolonged spell of hot, dry weather, a flush of sappy growth produced severe scouring and loss of condition in all the experimental calves, particularly the control group, which had had no copper up to this time but had held its own with the copper group.

After this setback all calves (treated and untreated) were given a half tube injection of copper cerate plus several doses of fine-particle phenothiazine at intervals to clean up a heavy worm infestation.

These treatments finally overcame the setback and the calves continued to thrive, but since the experiment had been somewhat confused toward the end by several departures from planned procedure, it was written off as inconclusive.

Up to mid February 1958, however, there was evidence from monthly weighings of little real benefit from copper treatment, both groups of calves growing normally.

During this second year and subsequently all cows in the dairy herd received an injection of one tube of copper cerate after calving.

The cows were treated with copper so that any possibility of copper deficiency would be eliminated while the effect of improved management was being studied. The reasons for supposing that copper deficiency might be involved were high molybdenum in the pasture and scouring symptoms in cattle like peat scours, which is known to respond to copper treatment. The controlled study of the existence of copper deficiency was made on calves in 1957-58.

Little can be said of the efficacy of this treatment, except that scouring seemed to decrease soon after. Some cows seemed to benefit from more than one treatment a year, a second full-tube injection about six months after the first usually producing excellent results.

1958-59

Because the copper trial in 1957-58 was unsatisfactory, it was repeated the following season, but instead of treating each member of the copper group of calves twice with a half tube of copper cerate as before, they were given a full-tube injection on each occasion (October 1958 and January 1959).

Sixteen calves were again separated into two groups of eight, one as a copper treated group and the other as a control. During the trial all calves of both groups were drenched with phenothiazine against internal parasites.

Results

Monthly weighings revealed no significant difference between the copper and control groups up to wean-

Rank growth of cocksfoot and cowgrass resulting from insufficient subdivision and too few stock at the beginning of settlement was thought to be the main factor in animal ill thrift. Four years' experimental work finally indicated that this was so.

ing in January 1959. Neither was there any marked difference in general appearance after weaning, all calves being in good condition. From this and the previous year's trial it was concluded that additional copper administered direct to the animal played little if any part in offsetting any adverse effect that could be due to a high level of pasture molybdenum.

1959-60

After the negative results from experiments with cobalt and copper administered to calves under strictly controlled conditions it was decided to ascertain the effect of selenium in the fourth and final year of the investigation.

Some encouragement had been given for this in a small pilot trial started the year before with eight calves, four treated with 10 mg of selenium and four untreated controls.

Twenty-four calves were weighed at birth and divided into two groups, one a selenium treated group and the other an untreated control. The trial began on 19 September 1959 and ended on 28 April 1960.

Until mid November selenium was administered fortnightly as a drench at 5 mg per dose. Thereafter the dose was increased to 10 mg.

During the whole of the experiment both groups were run together and treated alike except for the treatment given the selenium group. Weighings were made monthly as in earlier trials and a close watch was kept for evidence of parasitic infestation.

Results

For about four and a half months there appeared little difference between the two groups of calves except that members of the selenium group seemed to have a somewhat glossier and healthier coat than the controls.

Body weight differences between the groups were of no moment. In February heavy rain stimulated pasture growth to resemble that of mid spring.

After this unexpected and unseasonal growth it soon became evident (confirmed by monthly weighings) that whereas the selenium group continued normal progress the controls lost condition for two months and then began slowly to regain it.

At the end of the trial late in April 1960 there was an average body weight difference of $33\frac{1}{2}$ lb in favour of the selenium group. The reason for this is not known at present, but it is hoped that further large scale district

EXPERIMENTAL FINDINGS

- In a four-year experiment it was shown that feeding cobalt and copper played no significant part in alleviating symptoms of ill thrift in dairy calves on Rotomahana mud country. However, some mature cattle seemed to benefit from occasional copper injections.
- Selenium appeared to maintain normal growth rate in calves after the control (untreated) calves had slipped back in condition after a flush of growth in late February resulting from heavy rainfall on summer-dried pastures. The reason for this is unknown at present.
- Application of good farming methods resulted in the development of normal ryegrass-cocksfoot-white clover pastures, improved animal health, and increased carrying capacity and production.
- Internal parasites in calves, particularly weaners, can be a real menace after autumn rains. Intense scouring and wasting, culminating in death, can often follow failure to recognise the symptoms early enough and treat accordingly.

trials with selenium and selenium plus copper will throw some light on it.

It is clear from the above trials over four years that little emerged from the administration of either cobalt or copper; and that only selenium, at the end of a trial and under certain weather and growth conditions, produced results sufficiently encouraging to warrant further study. Yet, over the whole period, it was clear that general animal health was improving while production and carrying capacity were increasing.

The following figures from the trial confirm this:

Season		Cows milked	Other cattle	Butterfat lb	Butterfat per acre lb
1956-57	..	71	11	13,600	178.9
1957-58	..	77	21	18,200	180.2
1958-59	..	82	24	22,000	217.8
1959-60	..	77*	44	23,600	233.7

* 82 cows calved, but five died of bloat, etc., early in their lactation.

What factor or factors were responsible for such obvious progress, if most of the treatments produced virtually negative results? Undoubtedly the answer seems to be more closely associated with the normal, routine management of the property than anything else.

This is the experience of many other farmers in the affected area who, over the years, have also succeeded in overcoming their earlier troubles with calf rearing and low cow production largely through the application of well recognised farm management techniques.

On the experimental farm these management methods were merely:

Improvement of pastures and better control of their grazing by adequate subdivision;

A topdressing programme designed to meet the reasonable needs of stock without creating an embarrassing surplus growth which is always difficult to handle;

Oversowing certain paddocks with short-rotation ryegrass for winter and early spring feed;

A programme of root cropping (swedes) to even up the surface of paddocks before their regrassing;

Conserving all surplus pasture as silage;

Making the utmost of 8½ acres of lucerne as silage and baled hay;

Ensuring maximum food utilisation through not being understocked (as feed supplies improve so must the numbers of productive animals increase);

Regular and careful handling of stock in and out of the milking shed.

That internal parasites can play havoc with young animals, particularly after weaning and autumn rains, was forcibly brought to notice on more than one occasion; hence the need for a close watch on this probable source of trouble.

Acknowledgment

The cooperation of Messrs G. Brown, then Superintendent of Land Development, Rotorua, J. Holmwood, State Advances Corporation, and I. R. Merrett, the owner of the farm, in getting this work under way quickly and of enabling it to be carried through smoothly is acknowledged.

Book Reviews

"Eucalypts for New Zealand Farms, Parks and Gardens": F. B. McWhannell

A REFERENCE book on eucalypts for New Zealand conditions by F. B. McWhannell is welcome news to farm foresters.

In the past many mistakes have been made with the planting of eucalypts. The results of incorrect siting and selection of unsuitable species can be seen in many a woodlot. Over the last 15 years much valuable information has been gathered on the identification, cultivation, and timber properties of the various species and a summary of our present knowledge was badly needed.

McWhannell's book will serve this purpose admirably. The author has an intimate knowledge of eucalypts and is regarded as one of the best authorities on the subject.

This book is written in non-technical language—botanical terms are as much as possible avoided—and describes some 140 species under three headings. The largest section describes 87 species suitable for farm planting; two smaller sections deal with flowering and ornamental species and with eucalypts of less importance.

It could be argued that from a farm forester's point of view too wide a range of species is given as suitable for farm planting. In farm woodlot establishment there appears now to be a tendency to limit the selection to a small number of the better milling eucalypts. However, in the introduction the author gives a very useful list with timber qualities of the various species, and the prospective planter should carefully make his selection, bearing in mind the ultimate use of his trees.

In alphabetical order each species is first given a short botanical description followed by valuable practical information on such important factors as soil requirements, frost hardiness, ease of transplanting, and timber uses and qualities.

Clear illustrations of the flower buds and seed vessel of each species will assist in identification. Some species are illustrated by a full page photograph.

This should prove a reference book of considerable value to all interested in eucalypts and should be placed within easy reach in a farm forester's library.

—*C.W.S.v.K.*

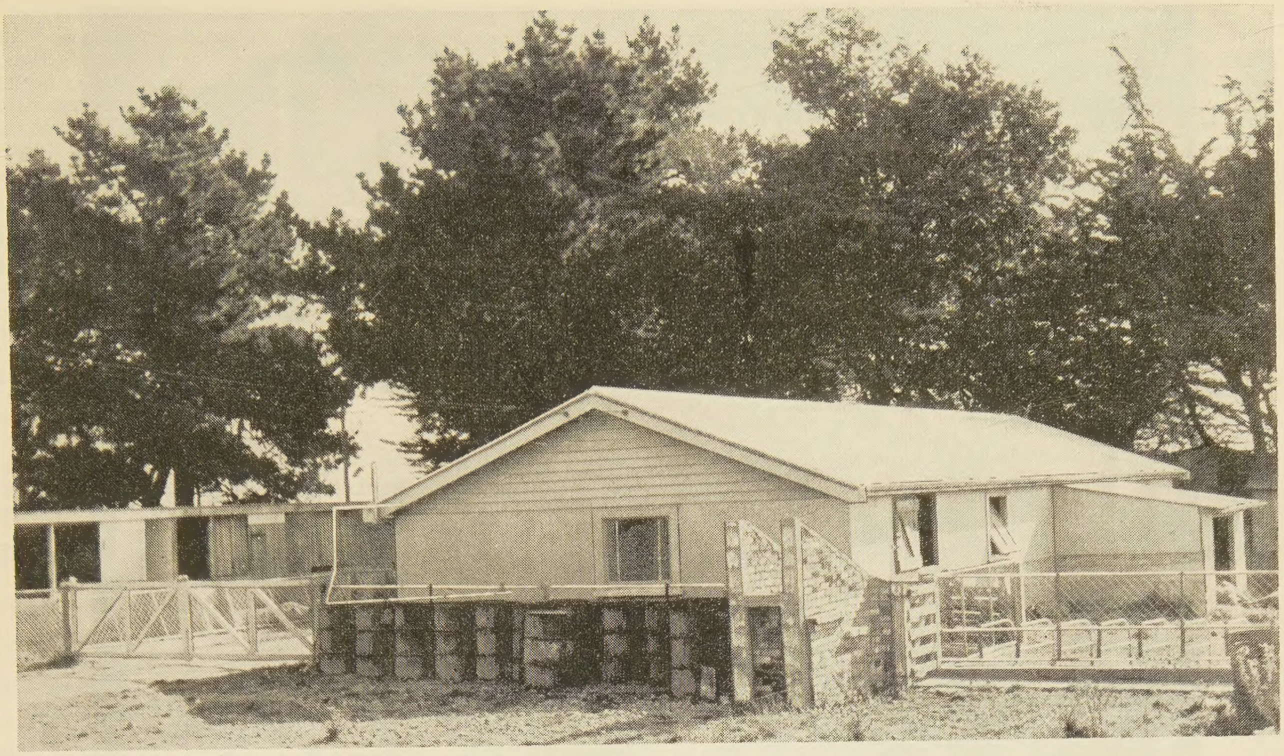
Paul's Book Arcade. 45s.

"Industrial Fibres, 1960" (No. 10): Commonwealth Economic Committee

"INDUSTRIAL FIBRES" presents in convenient form reviews of production, international trade, consumption, stocks, prices, and Customs duties for the following commodities: wool, cotton, rayon and other man-made fibres; mohair and other fine hair, silk, flax, jute and jute manufactures, sisal and other hemps, coir, and kapok. The present volume covers, in detail, developments up to the close of the 1958-59 season, and comparisons are given for earlier post-war seasons as well as for the average of the five immediate pre-war years. In each section particular reference is made to the part played by Commonwealth countries and to their interests, whether as producers or consumers.

The present edition (the tenth in the post-war series) contains all the regular features of earlier editions brought up to date and much new material.

Obtainable from H.M. Stationery Office, London, or Secretary, Commonwealth Economic Committee, 2 Queen Anne's Gate Buildings, Dartmouth Street, London, SW1. 10s. net (10s. 10d. posted).



HEADING PHOTOGRAPH: A well planned layout goes a long way to assist good management, but is not a substitute for it. In this piggery farrowing and fattening accommodation as well as that for the dry sows is conveniently arranged with communicating races to yards and loading ramp.

Making the Best Use of Pig Housing

Many types of pig houses are in use today, some designed for a special purpose, for example, farrowing, and others all purpose, varying from old half tanks to modern multiple units. Aspects of management which govern the efficiency of pig housing are discussed in this article by E. D. EDWARDS, Research Officer, Department of Agriculture, Wellington.

THE advantages of rearing pigs under optimum conditions of environment as demonstrated at research stations and by some commercial producers are perhaps not widely known. Possibly also the application of modern methods to pig farming in New Zealand may require more skill and time than the average dairy farmer is able to give.

However, profits depend mainly on management and the provision of pig housing should be viewed as more than a convenient shelter for rearing pigs from birth to slaughter. Proper management of pigs is not entirely related to labour shortages either, as minimum attention to pigs can be seen on farms reasonably supplied with labour as well as on farms hard pressed for labour. Perhaps the problem is simply one of a traditional approach by New Zealand farmers, whose experience of heavy losses of pigs has disheartened them.

The part that pig housing plays in pig raising is similar to that which the milking shed plays on the dairy farm.

Hard work and capital outlay needed to grow more grass and breed good stock are wasted if the milking technique is poor. With pigs, one or even two hours a day may be spent feeding and cleaning out, but if the housing is not good, money is steadily lost because of wasted food and dead stock.

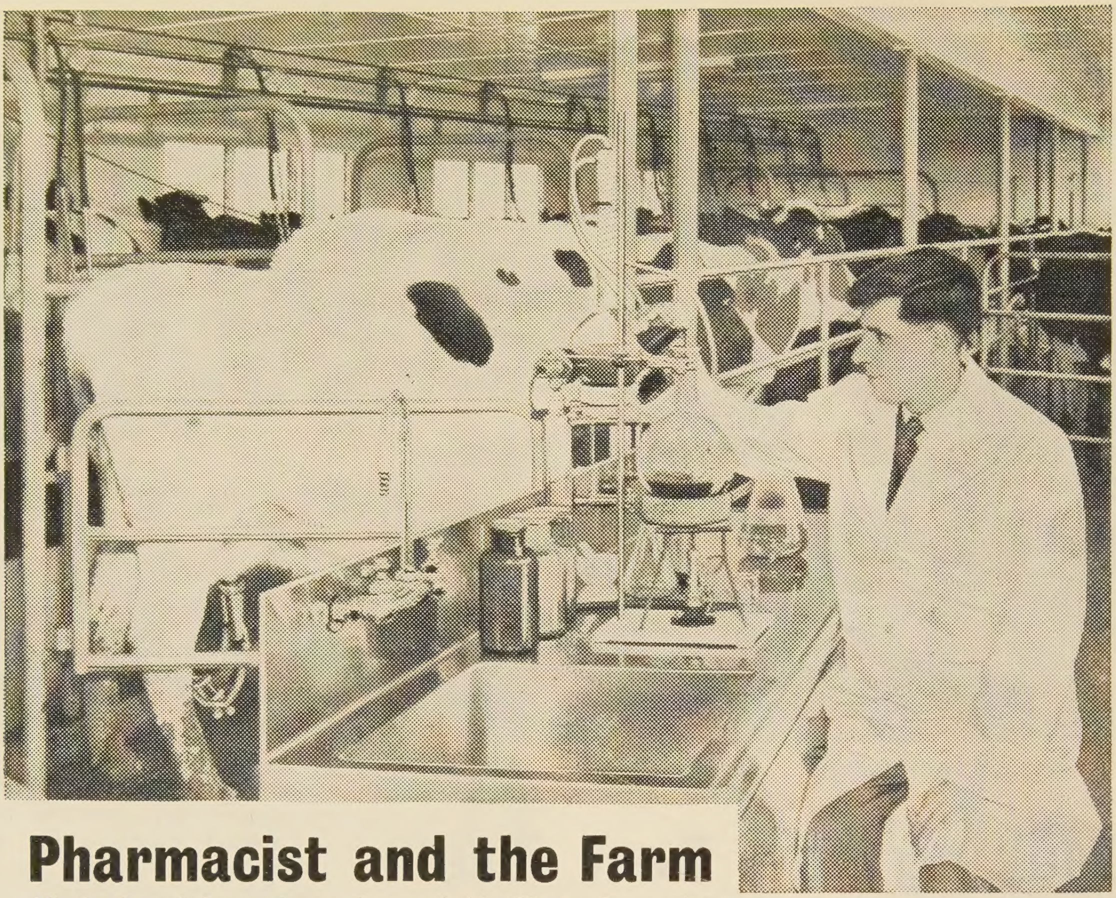
Housing can also influence carcass quality. No small amount of pigmeat produced here is sold at a discount for reasons of quality.

Housing and Production

The difficulty of getting enough pigs of the right size on hand for spring has disheartened many farmers and warrants special consideration, as it affects housing policy. Irregular breeding due to inadequate feeding and care of the sow is the chief cause of this. If more sows are carried to counter an existing problem, the difficulties of stocking and housing are intensified and often result in severe losses of pigs at birth because farrowing accommodation is far from satisfactory.

The design and use of housing are thus very much affected by sow management. Special farrowing units for irregular use are not considered to be warranted, so fattening units usually have priority in building, if only because they allow the bigger pigs to be kept under control.

However, it is better to use units which are designed for farrowing in sufficient numbers to cope with the farrowing programme and ensure that all pigs possible are available for fattening or sale as required.



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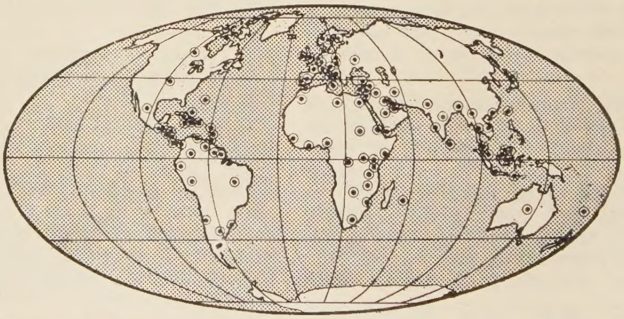

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Fattening accommodation should be the secondary consideration. The extent to which farrowing accommodation can be used for fattening varies with design and feed supply, and dual purpose units are common.

The requirements for housing a suckling pig and a fattening pig are quite different, however, and each will make better progress if these are met. Suckling pigs must have really warm quarters without draughts, and sleeping areas must give these conditions until the piglets are safely weaned. The piglets, however, will come to no harm romping in cold air outside; in fact they will be much healthier for it and probably be less susceptible to mismanagement later.

Fattening pigs require a lower temperature than suckling pigs, but will grow more efficiently kept in a fairly **uniform** environment at all times.

A properly planned and constructed creep area with self-feeder constantly supplying meal for the litter is an essential of good pig husbandry.

Better Use of Housing

Three ways in which existing housing can be improved are:

1. Adequate feeding, particularly of sows and young pigs.
2. Providing warm, dry sleeping quarters for all classes of growing pigs and lactating sows.
3. Adopting a regular plan of disinfection of pens, especially farrowing units and weaner units.

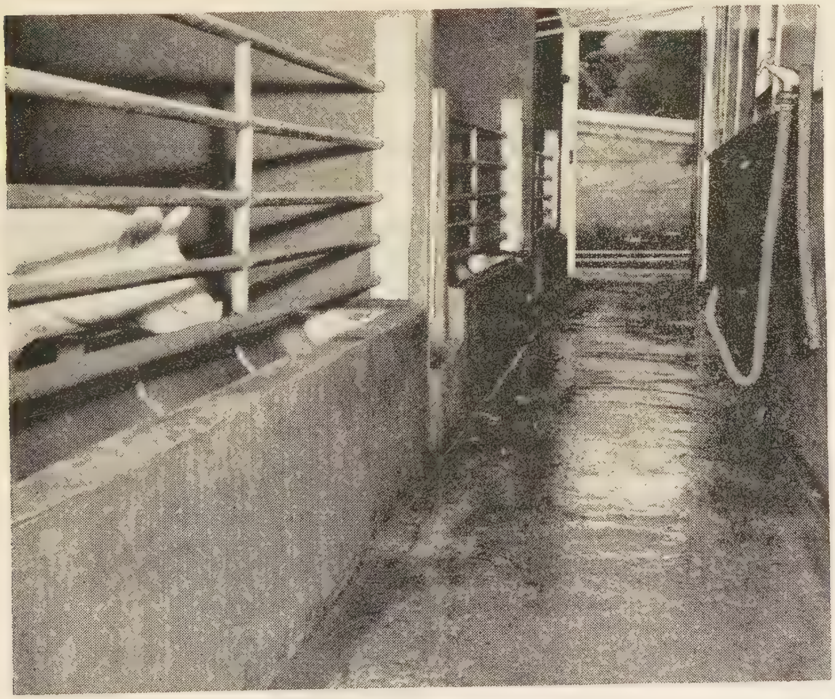
Feeding

Stock which are fed incorrectly are much more susceptible to the effects of poor housing and sanitation than are well fed pigs and may make cleaning much more difficult.

Feeding during lactation, especially if unbalanced or altered suddenly, greatly influences the health of suckers.

Baby pigs need regular access to clean soil for iron as soon as they are able to get about freely—within four days. If this is not possible, it is advisable to supply them with iron as soil or ferrous sulphate. This is more important during winter. Also chilling in cold houses reduces the effectiveness of the body reserve of iron and encourages anaemia.

Scouring due to nutritional faults opens the way to bacterial infection and is often difficult to clear up unless caught early.



Damp floors and fully open ventilation will reduce temperature in the enclosed fattening house on excessively hot days. In winter, however, water should be used sparingly and swept off the floors so that they dry quickly.

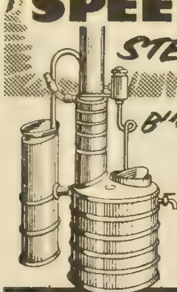
Much more attention should be given to the provision of creep pellets or meal to promote health and rapid growth and reduce the shock of weaning and associated problems in housing. Skim milk or whey is used more profitably when creep feeding (free access to meal for suckers) is practised.

Weaning Pigs

In winter and spring, when feeding and climate are often unfavourable, particular care is needed in weaning. If meal feeding were continued for a while after weaning, there would not be the problem there is. Feeding excessive amounts of skim or whey at this stage is unwise and also leads to fouling of sleeping floors. The use of up to 2 lb of meal per weaner daily is warranted until the milk is available and even after that 1 lb should be used and the amount cut back gradually.

Providing Warm, Dry Sleeping Quarters

Controlled ventilation about sleeping quarters is essential. Fresh air is beneficial in all types of houses, but not as cool draughts. This is most important with suckling pigs. Sacking



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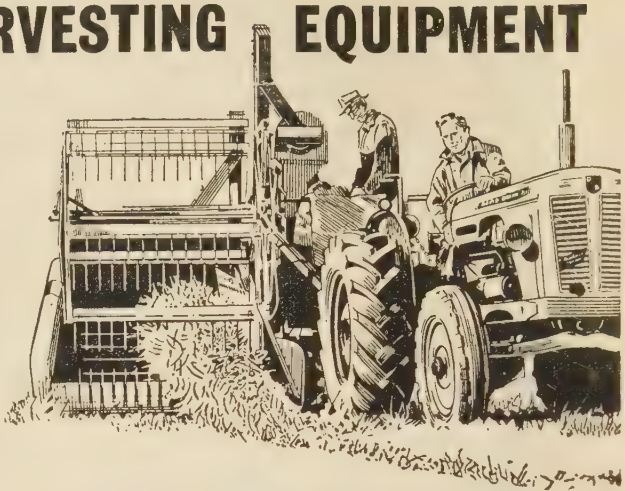

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tacked over doorways stops draughts, and if it is creosoted, the pigs will not show much interest in it. In enclosed houses vents should be able to be adjusted night and morning, but should not be opened too far in changeable weather.

Air movement normally accounts for the greatest loss of heat from the piggery. Heat is also lost by conduction, and the insulation of the roof and outside walls about the sleeping quarters should be improved, and, of course, in hot weather the entry of heat reduced.

Bare iron, aluminium, or even asbestos roofing is not sufficient to control air temperatures, as it can add to condensation and ventilation problems. The better the insulation of pig housing is the more ventilation can be provided.

In winter it may be easier to provide a kennel for small pigs to reduce to a minimum the air space they would need to heat. Even low covers over sleeping floors are very useful. A variety of materials can be used, but hay bales, loose hay on netting, netting and sacking, or reflective aluminium surfaces are easily obtained.

However, a house with built-in insulation is preferable, because cheap, temporary, or adjustable fittings for conserving warmth may not be used when required because the pigkeeper is too busy with other work.

Supplementary heat from electric lamps could be used by more farmers at farrowings, but precautions must be taken to ensure that the pigs enter the heated zone soon after birth and do not stray. The floor should slope toward the lamp rather than away from it. Proper drainage must be provided so that moisture does not collect in the warmed zone.

Good bedding, if it can be kept reasonably dry, solves many housing problems. However, too much loose hay increases the risk of overlying of suckling pigs and soon gets messed up by larger pigs. A recent move by some farmers to use deep-litter bedding shows promise, but all the problems in its use are not yet ironed out.

Better Hygiene

Some farmers no doubt raise pigs under filthy conditions with apparent success for long periods, but the odds are against it. If feeding is sound, the chances are good, though even in research units heavy losses occur owing to infection.

Sun and wind are useful agents in reducing the spread of disease, but in the piggery they should not be relied on to keep infection to a minimum. Regular daily cleaning of pens is advisable.

Periodically or when pigs are moved into different pens the unit should be thoroughly cleaned and disinfected. It ought to be possible to run the pigs out for a day until the sleeping floor dries out properly, but it is better if the pen can be spelled for a week or so.

This procedure may seem unnecessary where everything is going smoothly, but trouble often arises suddenly and causes very heavy losses. Also, a farmer whose piggery is clean is more likely to receive ready assistance from a veterinarian.

In enclosed piggeries in particular a higher standard of cleanliness is necessary, and the design should enable rapid removal of waste.

What could be simpler? Open the pen door and these pigs are on the way up the ramp to market.

Radio Broadcasts for Farmers

RADIO broadcasts for farmers will be given during January as follows:

2XP New Plymouth, 8 p.m.

5 January—"News and Views from the Farm Advisory Division", by G. R. Moss, Farm Advisory Officer, Department of Agriculture, New Plymouth.

19 January—"Early Wanganui Wool Sales", by P. C. Marshall, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

26 January—"Radio Vet.", by J. H. MacDonald, Veterinarian, Department of Agriculture, New Plymouth.

Regular Sessions

1YA Auckland, Mondays at 12.36 p.m. ("Country Journal", including "Report from Ruakura"), Tuesdays, Wednesdays, Thursdays, and Fridays at 7.45 p.m. ("Country Journal"), Thursdays at 12.33 p.m. ("News for the Farmer").

1XN Whangarei, Mondays at 8 p.m. ("Northland Stock Market Report", followed by "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 12.33 p.m. ("Farm News").

1XH Hamilton, Mondays at 12.36 p.m. ("For the Farmer", excluding first Monday in month and public holidays), Wednesdays at 12.33 p.m. ("Report from Ruakura").

1YZ Rotorua, Wednesdays at 7 p.m. ("Bay of Plenty Journal"), Thursdays at 12.33 p.m. ("News for the Farmer").

2YZ Napier, Tuesdays at 7.10 p.m. ("The Hawke's Bay Farmer"), Thursdays at 12.33 p.m. ("News for the Farmer").

2XG Gisborne, Tuesdays at 8 p.m. ("Farm Session").

2XP New Plymouth, Thursdays at 8 p.m. ("Farm Session").

2XA Wanganui, Mondays at 8 p.m. ("For the Man on the Land"), Tuesdays at 8 p.m. ("Farm Supplement"), and Thursdays at 8 p.m. ("Farm Topics").

2XB Masterton, Fridays at 6.45 p.m. ("Farm Session").

2XN Nelson, Thursdays at 8 p.m. ("Nelson Farm Topics").

2ZA Palmerston North, Mondays at 12.36 p.m. ("Country Digest") and Fridays at 8.30 p.m. ("Country Digest", including Feilding stock market report).

2YA Wellington, Mondays, Tuesdays, and Fridays at 7.10 p.m. ("Farm Session"), Thursdays at 12.33 p.m. ("News for the Farmer").

3YA Christchurch, Mondays at 12.20 p.m. ("Country Session"), Thursdays at 12.33 p.m. ("News for the Farmer"), and 7.10 p.m. ("Home Paddock").

3XC Timaru, Wednesdays at 8 p.m. ("Farmers' Weekly News Service") and Saturdays at 10.30 a.m. ("Country Mailbag").

3YZ Greymouth, Mondays at 12.36 p.m. Thursdays at 12.33 p.m. ("News for the Farmer").

Care of Livestock during January

By Wallaceville and Ruakura Animal Research Stations

SHEEP DIPPING

MODERN dips are so effective that the eradication of lice and ticks should be quite feasible. Best results, however, will be achieved only if the instructions for mixing and replenishing dips are followed accurately. Carelessness in dipping can cause disastrous losses. If sheep are dipped off shears, the shear cuts are liable to become infected and deaths from blood poisoning may occur. These can be prevented by vaccinating with blackleg vaccine at least a fortnight before dipping. The vaccine is available at a reasonable price. Departmental Veterinarians or Livestock Instructors should be consulted regarding its use.

ST. JOHN'S WORT MAKES DIPPING DANGEROUS

Sheep that eat St. John's wort become sensitive to sunlight and scabs develop on the ears, face, and back. If sheep in such condition are dipped, they take convulsions and may be drowned. If possible, sheep should be grazed on country free from St. John's wort for several weeks before dipping. If this is not possible, dip on dull days only.

LAMB WEANING

Weaning is an important event in the life of a lamb and special care at this time will be well repaid. Long wool lambs should be shorn and all others crutched. Hogget ill thrift in the North Island seldom manifests itself before the flush autumn growth appears. Before this time lambs should be given the pick of well controlled pastures, as these give best liveweight gains. At first sign of failure to do well on such feed they must be given the longest and most mature feed available. In most districts preparations to have such feed available must be made before the summer dry spell.

The hoggets should be stocked as lightly as possible for best results. Drenching is seldom necessary during the dry period, and the first drenching should be about two weeks after rain and should always be followed by an immediate shift into a clean paddock, preferably prepared in advance by cattle. Drenching of the hoggets may be necessary at about three-weekly intervals during warm, humid conditions.

TEST FOR COBALT DEFICIENCY

Cobalt deficiency may be a cause of unthriftiness in lambs from an early age, but is more likely to be important from about weaning time onward. If the disease is suspected, a trial should be conducted to measure the effect of dosing with cobalt. Cobalt bullets are suitable for this purpose, but have certain limitations. Local officers of the Department of Agriculture should be consulted about the planning of such trials.

GRAZING MANAGEMENT OF DAIRY CALVES

Calves which are not well grown by this time of the year will be difficult to get through the winter unless they are given special attention now. Carefully controlled experiments have consistently shown that a system of rotational grazing gives far better results, even through paddocks with apparently little feed available, than a system of set-stocking on long, mature pastures. A daily ration of 5 to 10 lb of good quality silage is a suitable supplement to summer pastures and will be amply repaid by less trouble later in winter.

MILKING MANAGEMENT

High-producing cows usually have a long lactation. Recent research at Ruakura reveals that milking technique plays an important part in keeping cows in production. In many cows the duration of milk let-down begins to decline from November onward. From this time through to the end of the lactation an adequate stimulus is essential to encourage maximum production. A 30 second wash is sufficient to start let-down in most cows. During this period the udder and teats should be hosed with running water and at the same time firmly rubbed with the hand. As a routine, a squirt of milk should be drawn from each teat. This not only helps to stimulate let-down but serves to check each quarter for mastitis.

EWE FLOCK MANAGEMENT

Do ewes get fat because they are dry, or dry because they are fat? In spite of the widely held view that fat ewes are often difficult to get in lamb, research at Ruakura indicates so far that the ewe flock which is fat just before mating grows more wool, produces more twins, and has fewer dry ewes than one in which the ewes are thin. Such findings suggest that there is no good reason for grazing the ewe flock from weaning onward any harder than is necessary to ensure that sufficient feed is saved for the lambs and cattle and for flushing later.

MANAGEMENT OF RAMS

Ninety per cent of ewes are tupped during the first four weeks of the mating period. To cope with this concentrated effort the rams must be fit, fertile, and free from infection. Those unlikely to meet these requirements should be culled now. Replacements should be bought in ample time to allow them to settle down and become acclimatised in their new environment.

Vaccinate those rams not already protected against *Brucella* infection at least two months before tupping begins. Shear them, dip early, and get their feet in good order by careful trimming.

Four to six weeks before mating flush the rams on good feed, preferably in paddocks with ample shade.

SELENIUM AND ANIMAL HEALTH

Some forms of unthriftiness in lambs before and after weaning can be prevented and controlled by selenium administration. Details of treatment for unthriftiness and other disease conditions responsive to selenium appeared in the October issue of the "Journal".

DIELDRIN AND ALDRIN RESISTANT BLOWFLIES

In certain areas of New Zealand, especially in Marlborough and Hawke's Bay, some strains of sheep blowfly have developed resistance to dieldrin and aldrin. It is almost certain that resistance will appear in other areas. Where it exists the use of dieldrin and aldrin for fly control should be discontinued, because doses many times those ordinarily used will not kill the flies or maggots. Flies resistant to dieldrin and aldrin are quite susceptible to the organophosphorus insecticides.

Seasonal Notes

By Farm Advisory Division

MAINTENANCE OF DAIRY FARM RACES

WITH annual maintenance the dairy farm race will remain in good order throughout the year.

Potholes which develop every year with constant stock and tractor traffic should be filled in. Clay should be used as a filling in preference to metal, as the clay base must be built up to shed water. With metal filling, water will still be trapped and lie in the basin underneath, and the metal will be trampled out of sight.

A tractor blade or preferably a grader should be used to touch up the camber and maintain the high crown essential for rapid water runoff. If the race is to be resurfaced, the material known as "rotten rock" should be used, as it packs down better than hard, flinty rock. Hard metal can also lead to foot troubles.

A race is particularly valuable in late winter and spring, as traffic and resultant poaching of pastures are reduced. Maintenance should be carried out this month to enable the race to consolidate before winter.

—*G. J. BATTEN, Thames*

* * *

PREVENTING WEEVIL DAMAGE IN YOUNG BRASSICA CROPS

IN dry seasons damage to seedling brassica crops by the stem weevil (*Hyperodes griseus*) or the weevil *Catoptes* sp. can be so severe that the crop has to be resown. Damage occurs soon after germination, the young leaves being eaten and stems chewed through at ground level.

The weevils can be controlled by applying the equivalent of either ½ lb 100 per cent lindane or 1 lb 100 per cent DDT. If springtails are also suspected of causing damage, lindane must be used, as these insects are not controlled by DDT. The chemicals must be applied to the ground surface, as the insects never move more than ¼ in. below the surface. A thoroughly cleaned, low-volume weed sprayer applying the chemical as an emulsion in 10 gallons of water per acre is suitable equipment.

Farmers who regularly have trouble should apply a preventive treatment straight after sowing. It would cost 18s. an acre for chemicals plus the cost of application.

—*E. DELAHUNTY, Ashburton*

* * *

WHEN TO EXPECT AN ATTACK OF ARMY CATERPILLAR

ATTACK by army caterpillar cannot be predicted with complete precision, but we can tell when conditions are suitable for the pest and keep a closer watch for it.

A female moth can lay up to 1,000 eggs, and if conditions favour the pest, epidemic populations can be built up on any area of pasture or crop without invasion from outside.

Moths seem to favour long growth in which to lay their eggs, especially if it is undisturbed by heavy stocking. The caterpillars must have succulent feed for survival, so that a severe attack is unlikely when there is no fresh growth.

Because the long growth of a hay crop favours egg laying and its succulence offers the sort of feed the caterpillars need, hay aftermath is particularly liable to attack. The aftermath from paspalum is more liable to attack than that of ryegrass because paspalum is available for haying later in the season and there is more time for the population of the pest to build up.

Newly sown pastures and cereal crops, because of their succulence, are vulnerable to attack by invasion from outside areas during autumn, while cereal crops, including maize, are also liable to attack from the following December onward.

Because land subjected to a summer flood is particularly liable to invasion from army worm, it should be watched very carefully with a view to taking remedial measures.

—*G. L. BANFIELD, Dunedin*

* * *

HARVESTING GRASS AND CLOVER SEEDS

FOR maximum yield of ryegrass seed crops and highest germination potential of the seed harvested the crop should be cut when the seed is fully formed but before too much has been lost by shedding. The best guide for testing the maturity of a crop is to shake a handful of heads against the inside of a hat and if the seeds fall readily, cutting should begin.

Heavy crops of perennial ryegrass are normally cut with a mower with an inside divider. The binder with the tying mechanism removed is recommended for windrowing light crops. Tying and stooking is the safest method of handling Italian or short-rotation ryegrass, but because of the labour required such crops are now generally windrowed or, if badly lodged, mown. These last methods, however, entail a far greater risk of heavy seed losses through shedding if rain falls after cutting.

The risk can be reduced by threshing before the seed is fully conditioned and by putting it in part bags to prevent overheating. The interval between cutting and threshing normally depends on the weather, but it is usual to leave perennial ryegrass for a week and Italian or short-rotation for 10 to 14 days.

White clover seed crops are best cut with a 4 ft 6 in. or 5 ft bar with an inside divider attached when at least 80 per cent of the flower stalks have turned light brown. In wet seasons continued flowering often makes it difficult to gauge the correct stage at which to cut, but it is usually best to cut after the second flowering is mature so that harvesting can be completed before vigorous autumn clover growth makes it virtually impossible.

Heavy rain on the swath may necessitate undercutting or lifting with a swath lifter or finger wheel rake to facilitate drying. If possible, this should be done in the cooler parts of the day to avoid undue losses of seed, particularly in ryegrass crops.

The header must be in first-class order for threshing. The drum speed should be kept as low as possible and the concave should be set to allow clean threshing without damaging the seeds. This applies to the weed seeds as well as the crop seed, because many an otherwise good line has been spoilt through faulty threshing so damaging the weed seeds that they cannot be removed in the later machine dressing.

—*J. L. SYMONS, Waimate*

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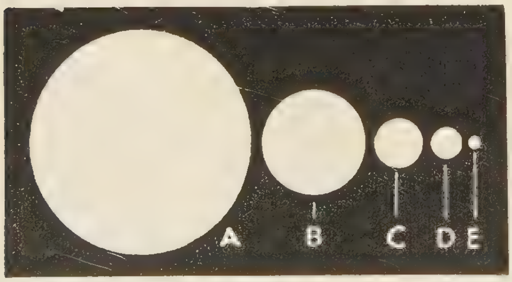
● **STABILITY OF SUSPENSION**	an absence of hard sediment in the tin.
● **PURITY OF PRODUCT**	denoted by the pale green colour.
● **FREE FLOWING**	fast and easy through the drenching gun.
● **UNIQUE PROCESS**	"Colloidal" process of manufacture exclusive to FARM CHEMICALS COMPANY, MAPUA, NELSON.
● **GENUINE FINE PARTICLE**	Talk on fine particles is largely meaningless to the layman unless he has some standard for comparison. The diagram below illustrates relative sizes of some everyday materials on the same scale as typical particles of TARTAN FENODREN 3 which have an average particle size by weight of less than one eight-thousandth of an inch diameter! It is now an accepted fact that the finer the individual particles of phenothiazine can be ground the greater the efficiency in the control of worms.



A—Particle of typical domestic flour.

B—Particle of high quality face powder.

C—Size of a Red Blood cell in the human body.

D and E—Typical particles of TARTAN FENODREN Phenothiazine.

TARTAN

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Hypomagnesaemia (Grass Staggers) in Beef Cattle

HYPOMAGNESAEMIA (grass staggers) though not a major livestock disease in New Zealand can nevertheless be a serious problem on some farms. Grass staggers is invariably associated with a fall in the level of magnesium in the blood of affected animals, but precisely what causes this has not yet been discovered. However, some ways of counteracting it, and therefore of reducing the likelihood of losses occurring, are known. In this article, which is an adaptation of a paper presented at the 1960 Ruakura Farmers' Conference by E. H. SHORTRIDGE, Veterinary Research Officer, Ruakura Animal Research Station, methods of control are suggested which offer a basis on which farmers can work to reduce losses from grass staggers.

IN beef cattle in New Zealand hypomagnesaemia, or grass staggers as it is popularly called, occurs most commonly in spring. The class of cattle most likely to be affected are cows within the first month after calving.

A very common history of an outbreak is that cows which had not been noticed abnormal when last shepherded are found dead. Very often these are cows with calves up to a month old.

Symptoms

If the animals are seen alive and on their feet, they have a nervous appearance with pricked up ears and staring eyes. They show jerky head movements, snort, and salivate, and very often are exceedingly belligerent. Their gait is stilted and they have a tendency to stumble. This stage terminates in most cases with the animal going down.

More commonly, even if the animal is found alive, it has already reached the stage of lying flat on its side with its head thrown back. The eyelids show fine tremors and the eyeballs are often rolled upward into the sockets until only the whites are showing. The ears twitch constantly and the jaws work, making the teeth grate with an unpleasant crunching noise. The forelegs pedal periodically and a semicircle of grass becomes eroded in the arc the forelegs describe. If subjected to even mild stimuli, the animal is often seized with violent convulsions, which may last for several seconds, great muscular activity being manifested. Death often intervenes during or after one of these convulsions, or the animal may pass into a deep coma and die.

The condition in New Zealand appears to affect older cows more commonly. British workers have found that there is an increase in the incidence of the condition with age and that a cow six years of age is 14 times more likely to be affected than is a heifer. A similar trend was demonstrated in dairy cows in the South Auckland area in a survey conducted in 1954-55. Newly calved cows are not the only ones affected and cases have been seen even in steers.

The incidence of the disease in beef cattle in New Zealand is not known, but overall is probably low, so that nationally it is not one of the country's major problems. On some farms, however, the incidence may be high, up to 20 per cent of the breeding cows being affected. It is then a very serious problem, as the response to treatment is so unsatisfactory, even if cows happen to be found alive. Grass staggers also appears to be becoming more prevalent as the country on which breeding cows are farmed improves in fertility, grows more highly

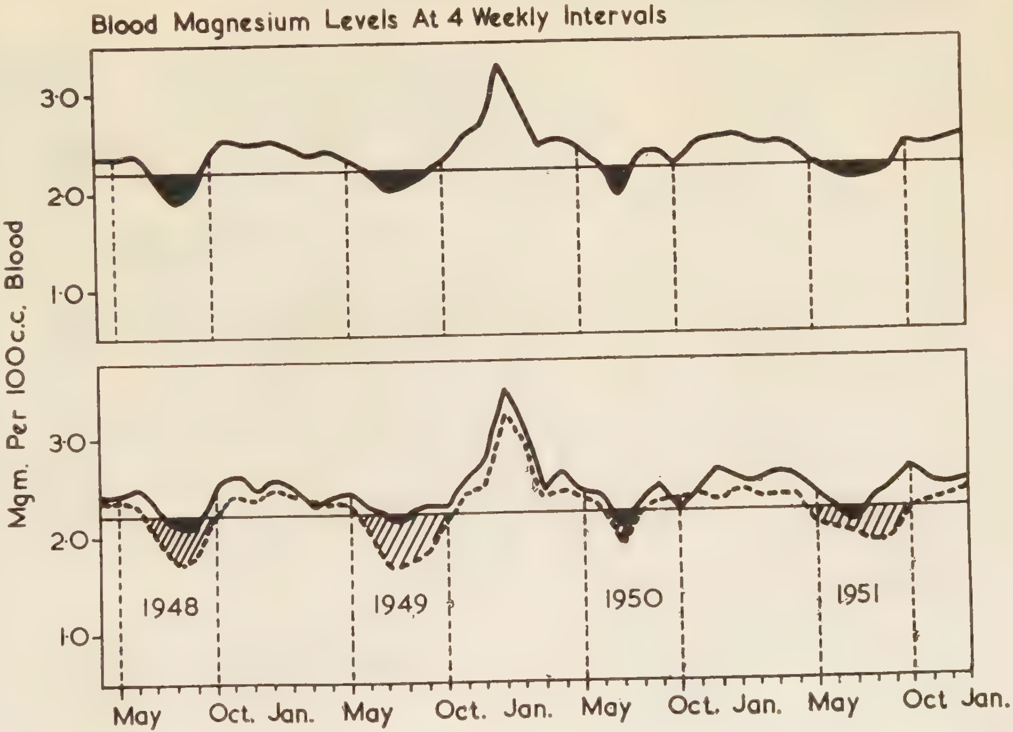

Fig. 1. →

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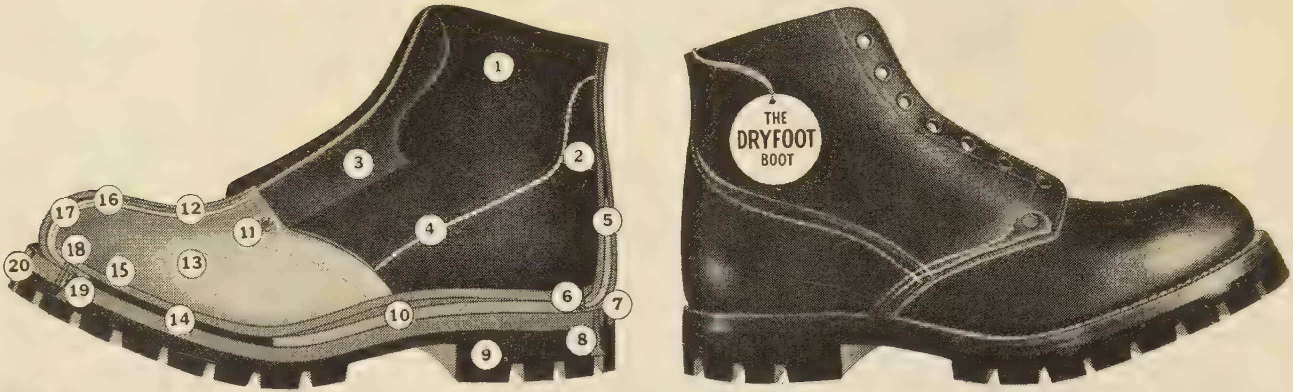

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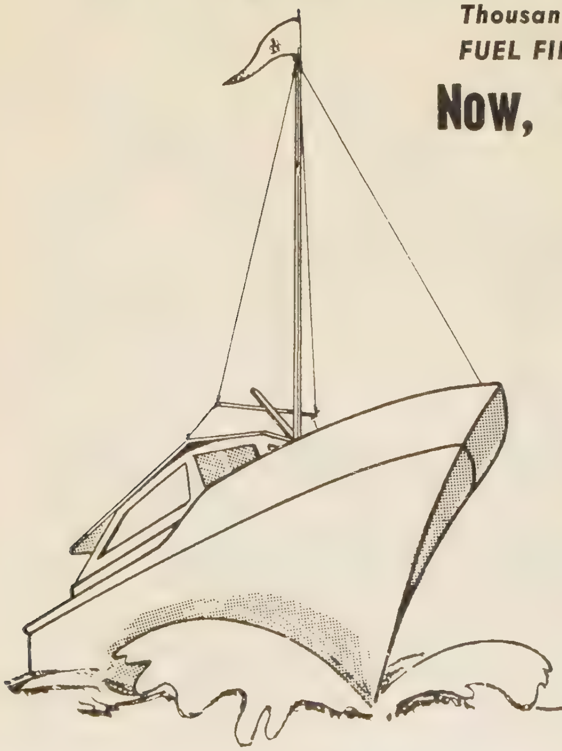

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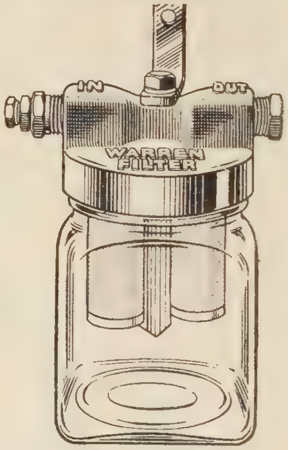

productive pasture, and carrying capacity rises.

Cause

A great deal of work has been carried out to determine the cause. The condition is invariably associated with a reduction in the level of the blood magnesium. This is what the term "hypomagnesaemia" means. Magnesium is necessary for efficient functioning of the nervous system, and when the blood magnesium level falls appreciably below normal, particularly if the fall is rapid, the nervous system is liable to become very sensitive and excitable. When this happens the symptoms described earlier occur and usually the animal dies.

The big question is: "What causes the magnesium level in the blood to fall?" No entirely satisfactory explanation is available, but much is known, and the facts will be reviewed briefly.

Low Magnesium Level in Blood

A low blood magnesium level may occur with or without clinical cases of staggers developing under at least four circumstances. It occurs as a seasonal phenomenon which does not appear to be a straightforward deficiency. It has been known to occur in calves fed solely on milk, where it is due to a deficiency of magnesium in the diet with staggers and death sometimes occurring. It occurs when animals are subjected to intense excitement such as in transit or under saleyard conditions in New Zealand. It occurs when there are sudden changes of feed, particularly a sudden reduction in feed.

The first of these conditions appears to be the most important as far as grass staggers in beef cattle in New Zealand is concerned.

That this seasonal variation in the blood magnesium level occurs here in dairy cows has been demonstrated at Ruakura. It could be presumed that a similar blood fluctuation occurs in our beef herds.

This seasonal variation has been studied extensively overseas. A close correlation between climatic conditions and the fluctuations in blood magnesium has been described by a British worker, severe weather appearing to coincide with a fall in blood magnesium.

This has also been suggested in New Zealand as a contributory cause of grass staggers. The reason for this is not known, but it may be due to the animal's increased bodily needs during adverse weather or to hormonal upsets.

R. R. White at Ruakura observed this seasonal fluctuation over several seasons and found, in a comparison of the fall in blood magnesium between two herds on different planes of nutrition, that the fall was greater in the herd on the lower plane (Fig. 1).

Dutch workers found that there was a relationship between the incidence of the disease and the protein level of the pasture. More recently similar observations were made in Britain, where it was found that animals on spring grass had a high rumen ammonia content and that blood magnesium levels could be depressed by producing a high rumen ammonia level chemically (by dosing with ammonium salts).

British workers have also found that the magnesium content of pasture often falls in spring to its lowest level for the year. If this happens in New Zealand, it means that at the time of the year when a beef cow requires its greatest amount of magnesium to produce a calf and milk, the cow's actual intake from pasture is at its lowest.

The other three circumstances under which grass staggers occurs may be of some importance in elucidating the cause.

Staggers developing in calves is of interest in that it appears to be a dietary magnesium deficiency in which symptoms do not develop until the magnesium reserves of the bones are seriously depleted. This is in contrast to the position in adults, where death from grass staggers can occur though the animal's body still contains a large reserve of magnesium in the bones.

British workers who have investigated this condition consider that it may be due to the magnesium in young bones being readily available to supplement the blood magnesium. As the bones mature the magnesium contained in them becomes fixed and is not so readily available as a source of the mineral to the bloodstream in times of need. This may be one of the reasons for an increase in the incidence of grass staggers with age.

Excitement such as occurs at saleyards with beef cattle appears to cause grass staggers and this will be mentioned again later when control measures are suggested.

Sudden changes in feeding, particularly a sudden reduction in feed levels, have been shown to be followed by a reduction in blood magnesium levels.

No single one of these observations or hypotheses appears to provide an answer to all the questions which can be raised. It is established, however, that seasonal variations occur in the blood magnesium level in at least some herds and some possible causes for these have been discussed.

Some workers consider that cattle with a low blood magnesium level are more likely to be affected with grass staggers than cattle in which the magnesium level in the blood has not fallen at all or not to such a low level. Some of the factors which trigger off

Directors of Animal Research Stations

ON the retirement in October of Dr J. F. Filmer from the position of Director of the Animal Research Division of the Department of Agriculture, the Superintendents of Ruakura Animal Research Station (Dr C. P. McMeekan, left) and Wallaceville Animal Research Station (Dr M. B. Buddle, right) were redesignated Directors.

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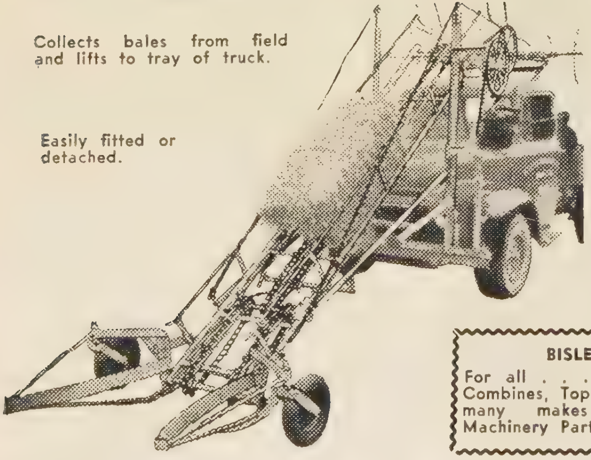

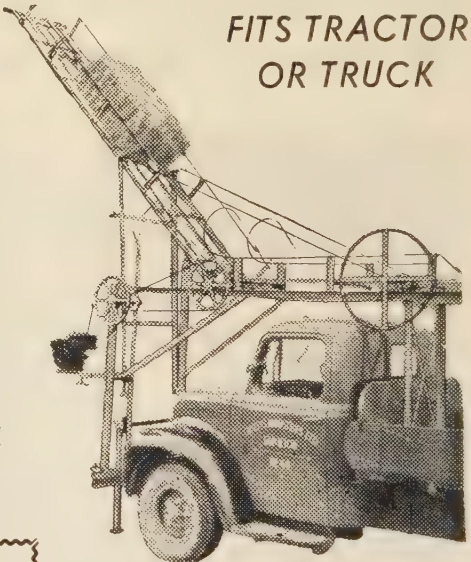

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a further rapid fall in blood magnesium level and produce staggers in these animals are excitement, calving, and bulling. Others could be sudden changes in feeding and adverse weather. Veterinarians are very commonly confronted with a sudden increase in grass staggers when climatic conditions are at their worst.

Combination of Predisposing Conditions

It will be seen that New Zealand beef cows are subject to a very effective combination of conditions which are believed to predispose them to grass staggers.

The fall in the blood magnesium level would be expected at the time of the year when the feed position on many meat and wool producing properties is at its most critical. Pasture growth, particularly in a late spring, is low. The demand for available feed for ewes and lambs is high, and consequently cattle often suffer. Adverse weather is often experienced and this has a twofold effect in stopping pasture growth and increasing the animals' feed requirements. High rainfall has also been shown to be associated with a low magnesium content of pasture.

If pastures are growing, the feed is of a young, high protein nature which has been found to be associated with low blood magnesium levels. All the factors considered to trigger off grass staggers could be operating; they are: calving, bulling, excitement, sudden changes of feed, and adverse weather.

Control Measures

On the available background knowledge some control measures can be suggested.

The first is that of supplementing the diet of beef cows in spring with extra magnesium. It has been suggested (with some supporting experimental evidence) that by increasing the daily intake of magnesium the magnesium level in the blood can be prevented from falling to a dangerous level and losses from occurring.

There are two ways of increasing the intake of magnesium: Firstly by giving stock magnesium supplements in the form of licks or mixtures made palatable by the addition of molasses; secondly by topdressing with a magnesium rich fertiliser.

The former method has been shown to be effective when an adequate daily intake can be assured, but this is difficult under New Zealand beef farming conditions. However, good results have been claimed in New Zealand by feeding the two magnesium salts most readily available here, magnesium sulphate and dolomite. Most British work was carried out with calcined magnesite, containing approximately 90 per cent magnesium oxide, which is now available in New Zealand.

A suggested daily dose rate of magnesium sulphate would be 2 to 3 oz, of dolomite 5 oz, and of calcined magnesite 2 oz. These can be compounded with salt and molasses to increase the palatability. A mixture suggested by a practitioner with considerable experience of grass staggers is:

	Parts
Dolomite	3
Salt	2
Molasses	5

Feed ½ pint per cow per day

Many difficulties can be pointed out with this as a method of control, but it is probably of use with other measures.

Pasture topdressing with a magnesium rich fertiliser has appeared to give good control in Britain under experimental conditions, but the topdressing was done at the high rate of 30 to 40 cwt per acre of magnesium carbonate mixture with about the same magnesium content as New Zealand dolomite. This, of course,, would be impracticable and uneconomic on most beef breeding farms here, but I think that it would be useful to know what is the minimum amount of magnesium as a topdressing which would give worthwhile control of grass staggers under New Zealand conditions. This could be investigated further.

At present management practices probably offer the best method of control. As inadequate nutrition and sudden changes in feed are important in predisposing cattle to grass staggers, adequate reserves of feed such as hay, silage, or saved pasture should be provided for the critical months. Enough of these should be available to avoid running out of them part way through the danger period, as this will often precipitate an outbreak of the trouble. During the danger period breeding cows should be spread over as much of the farm as can be allocated to them to avoid changes of paddock and hence changes of feed as far as possible, though this may make hay feeding more difficult.

As far as possible sheep should not be stocked heavily on paddocks with breeding cows, as they keep the grass too short.

Later calving of the cows could be of benefit, as the feed position is less likely to be so critical later in the season, but if this is done, hay should still be fed to the calving cows.

Adverse weather can be guarded against to some extent by the provision of more shelter by more tree planting or by calving in less exposed paddocks.

Excitement at the critical time of the year should be avoided and the cattle herded as quietly as possible.

Young cows are less likely to be affected than older animals, and a good degree of control is being achieved on some properties where the condition is prevalent by maintaining a young herd.

Preparing Hill Country for Oversowing

THE key to high carrying capacities on hill country is the establishment and maintenance of vigorous, high-producing clover. The clovers provide a good bulk of high-quality feed, but their main attribute is their ability to use applied fertiliser and produce large quantities of nitrogen, which benefits the associated grasses.

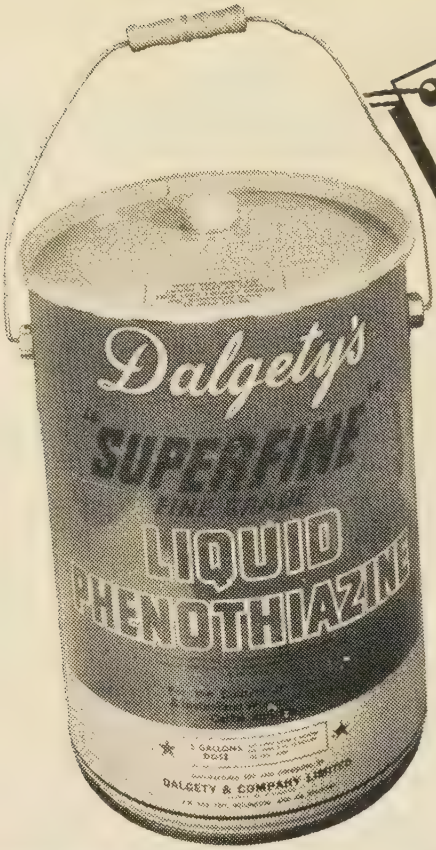
Each development block should be tackled systematically. It should be adequately fenced, and electric fencing is now used widely to reduce development costs. Experience has shown that one-tenth of the size of the farm can be handled each year. The main factors limiting the size of the area are available finance, labour, and stock.

The preparation of the development block during summer and early autumn is most important. Gorse and scrub should be cleared and burnt in readiness for autumn oversowing. The ewe flock after weaning is invaluable for clearing off the surplus pasture growth, and cattle are used to clean up the roughage.

All these operations are aimed at having the area in ideal condition for oversowing clover seed in autumn as soon as enough rain has fallen. White clover at 2 lb per acre is the main sowing, but subterranean clover and Montgomery red clover can sometimes be added.

On most hill country 2 to 3 cwt of superphosphate per acre is required with the seed, and inoculation of seed is often necessary. Correct fertiliser treatment is essential to establish high-producing clovers. Annual topdressings for several years are recommended. In some areas the application of lime, molybdenum, potash, or sulphur has to be considered and the advice of the Department should be sought.

—*A. K. BOOTH,*
Farm Advisory Officer,
Department of Agriculture,
Wanganui



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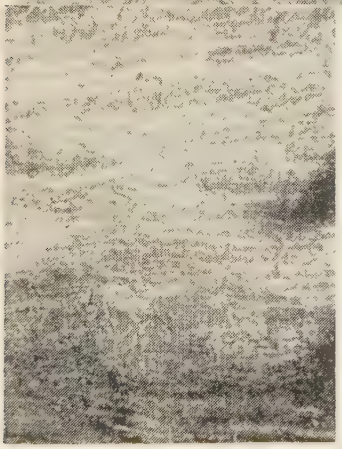

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Illus. 1. Nearing the top of a "wedged" stack showing the method of keeping the surface few inches compacted and the cover held down. Later trial work proved that the toe of stack (making the end of the stack 15-18 inches deep on the face), old hay or sawdust, to a depth of 6 inches, were sufficient for this purpose.

Illus. 2. Opening up the matured Silothene covered stack. Notice how perfect silage has been made right to the top. Usually the average loss in a silage stack is 40% of the ensiled material.

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Wilt-resistant Onward Peas

PEA wilt, a soil-borne disease caused by the fungus *Fusarium orthoceras* Appel. et Wollenw. var. *pisi* Linford, has been recognised as a serious limitation in pea seed growing. Normal crop rotation practices do not effectively control the incidence of disease and the most efficient means of overcoming it is by the use of resistant varieties.

By D. E. YEN, Crop Research Division, Otahuhu, and R. J. CASEY, formerly Crop Research Division, Lincoln, Department of Scientific and Industrial Research

BREEDING garden and field peas resistant to wilt was begun in New Zealand in 1949. An account of the methods used has been published (3). One resistant variety, Wilt-resistant Greenfeast, was released in 1957 (4). This was produced by selecting resistant plants from a mixed line of Greenfeast. Since no such resistance was found in the other important varieties in the export trade, William Massey, Onward, and Partridge, the slower improvement method of transferring resistance to them from resistant varieties had to be adopted. Wilt-resistant Onward is the first of these improved varieties ready for release.

Breeding

Onward was crossed with Delwiche Commando, an American variety resistant to *Fusarium* wilt. From the first generation after the cross recurrent back crossing to Onward was carried out to recover the Onward characters. Selection for these characters and for wilt resistance was applied when choosing individual plants to cross back to Onward at each stage. The lines finally tested for seed yield were derived from two sources of this material.

O lines: Lines were selected from single plants from the first generation of selfing after five back crosses to Onward. After selection for type, uniformity, wilt resistance, and yield in small yield trials two lines remained for testing in drill trials. In 1956 these lines had been through seven generations of selfing and selection.

E lines: Four lines were selected as above after seven back crosses to Onward. In 1956 they had been through five generations of selection and selfing.

Throughout this breeding procedure, selection has been exercised against "rabbit-eared rogue" (often called "tare-leaf") in the back cross parent and in progenies. When such rogues have appeared in progenies, the whole line has been discarded. Though early to assess the effectiveness of this selection, the Department of Agriculture officer in charge of the first increase of seed in Canterbury in the 1958-59 season has reported a much lower incidence of rogues in the wilt-resistant Onward lines than in the non-resistant stocks.

Plant Characters

In the six lines tested for seed yield no differences from Onward have been observed in growth, flowering, maturity of pods, or seed characters. Nor have differences been detected in tests of picking ability as a market garden crop (2). No susceptibility to New Zealand strains of *Fusarium* wilt has been found in the laboratory and field tests have shown complete resistance.

A bulk sample of the two O lines was submitted to the National Institute of Agricultural Botany, Cambridge, England, for testing in 1957. The results of these tests conducted in England show that this material has high field resistance to wilt (1). E lines 1, 2, and 3 sent in 1958 have shown similar results. E 4 was not included because of a slight difference in plant growth.

Seed Yield

The following table summarises the results of field trials at Lincoln in three seasons. The O and E lines were compared in separate trials in 1956-57, and all were included in one trial in 1957-58 and 1958-59. The yields given are from plots 2 chains long and 7 coulters wide.

SEED YIELD OF SELECTED LINES OF WILT-RESISTANT ONWARD PEAS

Selection number	Season 1956-57	 1956-57	 1957-58	 1958-59
	(bushels per acre)			
O 1	—	55.4	66.0	34.4
O 2	—	53.8	70.5	34.3
E 1	32.0	—	68.5	34.1
E 2	30.2	—	68.3	32.4
E 3	32.0	—	66.0	32.6
E 4	30.9	—	67.0	31.0
Onward ..	28.7	52.7	65.3	29.8
*Least significant difference (at 5 per cent level) ..	1.87	not significant	not significant	2.0

* Differences between selections in any one trial which are greater than the "least significant difference" for that trial may be taken as real differences. Other differences should be regarded as chance ones.

Each resistant line yielded significantly better than the Onward control in two trials and slightly though in-

Reactions of normal and wilt-resistant lines of Onward peas grown in wilt-infected selection plots at the Crop Research Division. Right, plots of Wilt-resistant Onward plants; left, normal Onward plants dying.

significantly better in the third. These differences in yield may have been due to the effect of wilt, which is widespread in the Crop Research Division area, as it is in much of Canterbury. Small patches of wilt have been seen in most trials and this infection, though slight, may have been sufficient to lower the yield of the susceptible Onward.

Seed Release

Release of Wilt-resistant Onward is through the customary pure seed scheme for peas. Single plant selections have been made by the Crop Research Division and are being increased in single plant lines. Stringent rogueing, similar to the procedures adopted in breeding work, is carried out. The Department of Agriculture then increases the bulk of these selected lines for distribution to merchants.

For the 1959-60 season, merchants interested in the growing of the Onward variety were offered trial lots of the wilt-resistant stock for field scale tests. The line of seed was a blend of lines from O 1 and 2, and E 1, 2, and 3. The favourable reaction of merchants on the results of growing this stock in six areas of Blenheim and Canterbury has led to a decision to release this stock and the Department of Agriculture has made seed available to some merchants for further multiplication in 1960-61. The future of this variety will depend largely on the interest taken in it overseas.

As long as Wilt-resistant Onward is not mixed with the susceptible strain of Onward peas it should show total resistance to New Zealand races of the wilt organism. Tests made in England indicate that it should behave similarly there under field conditions.

Acknowledgments

The work of Dr D. A. Doling, National Institute of Agricultural Botany, Cambridge, Dr E. W. Buxton, Rothamsted Experiment Station, and Mr J. D. Reynolds, Pea Growing Research Organisation Ltd., who cooperated in the testing of this material in England, is acknowledged.

Mr I. A. M. Cruickshank, formerly Mycologist, Plant Diseases Division, Department of Scientific and Industrial Research, collaborated in the early stages of breeding of Wilt-resistant Onward, and Mr N. L. Shillito, Seed Production Officer, Department of Agriculture, Christchurch, has been responsible for the supervision of extension trials outside this Division.

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(1) E. W. Buxton, D. A. Perry, D. A. Doling, and J. D. Reynolds, "The Resistance of Pea Varieties to *Fusarium* Wilt", Plant Pathology, vol. 8, No. 2, June 1959, p. 39.

(2) D. E. Yen and R. J. Casey, "Assessment of New Wilt-resistant Pea Strains for Market Growing", New Zealand Commercial Grower, vol. 15, No. 1, July 1959, p. 27.

(3) D. E. Yen and I. A. M. Cruickshank, "The Breeding of Peas Resistant to *Fusarium* Wilt", New Zealand Journal of Science and Technology, vol. 38A, No. 7, June 1957, p. 702.

(4) D. E. Yen and I. A. M. Cruickshank, "Wilt-resistant Greenfeast Peas", New Zealand Journal of Agriculture, vol. 94, No. 2, February 1957, p. 149.

Agricultural and Pastoral Show Dates

THE following are dates and venues of A. and P. shows up to the end of April 1961.

NORTH ISLAND

January 1961

2 January—Nuhaka A. and P. at Nuhaka.
14 January—Waipu A. and P. at Waipu.
14 January—Central Hawke's Bay A. and P. at Waipukurau.
20 and 21 January—Feilding I., A., and P. at Feilding.
20 and 21 January—Wairoa County A. and P. at Wairoa.
*27 and 28 January—Horowhenua A. and P. at Levin.
28 January—Galatea A. and P. at Galatea.
28 January—North Kaipara A. and P. at Paparoa.

February

*1 February—Marton District A. and P. at Marton.
3 and 4 February—Rodney A. and P. at Warkworth.
*4 February—Rangitikei A. and P. (Golden Jubilee) at Taihape.
4 February—Woodville A. and P. at Woodville.
4 February—Katikati A. and P. at Katikati.
*7 and 8 February—Dannevirke District A. and P. at Dannevirke.
8 February—Te Awamutu A., P., and H. at Te Awamutu.
10 and 11 February—Taranaki A. and P. at New Plymouth.
10 and 11 February—Taumarunui District A. P. at Taumarunui.
11 February—Hukerenui A. and P. at Hukerenui.
11 February—Tauranga A. and P. at Tauranga.
11 February—Pahiatua A. and P. at Pahiatua.
14 February—Otorohanga A. and P. at Otorohanga.
16 February—Matamata A. and P. at Matamata.
17 and 18 February—Franklin A. and P. at Pukekohe.
17 and 18 February—Ohura A., P., H., and I. at Nihoniho.
17 and 18 February—Masterton A. and P. at Masterton.
*18 February—Te Puke A. and P. at Te Puke.
18 February—Northern Wairoa A. and P. at Mititai.
22 February—Te Kauwhata A. and P. at Te Kauwhata.
24 and 25 February—Wellington and Hutt Valley A. and P. at Trentham.
24 and 25 February—Te Kuiti and District A. and P. at Te Kuiti.
25 February—Waiapu A. and P. at Ruatoria.
25 February—Mangonui County A. and P. at Kaitaia.
*25 February—Whakatane A. and P. at Whakatane.
25 February—Waimarino A. and P. (Golden Jubilee) at Raetihi.
25 February—Putaruru District A. and P. at Putaruru.

March

*1 March—Morrinsville A. and P. at Morrinsville.
4 March—Opotiki A. and P. at Opotiki.
4 March—Albany A. and P. at Albany.
11 March—Kumeu District A. and H. at Kumeu.
18 March—Wellsford A. and P. at Wellsford.

SOUTH ISLAND

January 1961

14 January—Wallace A. and P. at Otautau.
14 January—Blueskin A. and P. at Waitati.
*21 January—Waiau A. and P. at Tuatapere.
21 January—Golden Bay A. and P. at Takaka.
21 January—Peninsula Horse and A. and P. at Duvauchelle.
21 January—Waikouaiti A. and P. at Waikouaiti.
24 and 25 January—Otago A. and P. at Dunedin.
28 January—Banks Peninsula A. and P. at Little River.
28 January—Palmerston and Waihemo A. and P. at Palmerston.

February

2 February—Cheviot A. and P. at Cheviot.
*11 February—Inangahua A. and P. at Reefton.
18 February—Murchison A. and P. at Murchison.
25 February—Kaikoura A. and P. at Kaikoura.
25 February—Buller A. and P. at Westport.
25 February—Central Otago A. and P. at Omakau.

March

4 March—Temuka and Geraldine A. and P. at Winchester.
*4 March—Rai Valley A. and P. at Rai Valley.
4 March—Amuri A. and P. at Rotherham.
11 March—Mayfield A. and P. at Mayfield.
*11 March—Mt. Benger A. and P. at Roxburgh.
14 March—Lake County A. and P. at Arrowtown.
18 March—Hawarden A. and P. at Hawarden.
*18 March—Upper Clutha A. and P. at Wanaka.
*25 March—Methven A. and P. at Methven.

April

3 April—Strath-Taieri A. and P. at Middlemarch.
3 April—Mackenzie Highland Show at Fairlie.
8 April—Oxford A. and P. at Oxford.
*15 April—Malvern A. and P. at Sheffield.

* The Department of Agriculture exhibit will be staged at this show.

Wool Sales

The dates and venues of wool sales up to the end of June 1961 are:

11 January: Wanganui.
16 and 18 January: Auckland.
23 and 25 January: Napier.
30 January and 1 February: Wellington.
15 and 17 February: Christchurch.
22 and 24 February: Invercargill.
1 and 3 March: Dunedin.
8 March: Timaru.
15 March: Wanganui.
20 and 22 March: Auckland.
27 and 29 March: Napier.
12 and 14 April: Wellington.
19 and 21 April: Christchurch.
26 and 28 April: Invercargill.
3 May: Dunedin.
20 May: Wanganui.
24 and 26 May: Napier.
31 May and 2 June: Auckland.
7 June: Wellington.

Ram and Ewe Fairs

The following are dates and venues of ram and ewe fairs up to the end of March:

9 January—Wairarapa Stud at Masterton.
12 and 13 January—Wairarapa Flock at Masterton.
16 January—Wairoa County at Wairoa.
24 January—Second Feilding (Flock) at Feilding.
1 February—Timaru Stud Ram and Ewe at Timaru (all breeds).
2 February—Canterbury Stud at Addington.
9 February—Canterbury Flock at Addington (mutton breeds).
10 February—Canterbury Flock at Addington (wool breeds).
10 February—Dannevirke at Dannevirke.
17 February—Timaru at Timaru (fat breeds).
10 March—Timaru at Timaru (wool breeds).
28 January—Southland Stud at Invercargill (all breeds except Romney).
25 February—Southland Southdown Flock at Invercargill.
8 March—Southland Romney and Breeds other than Southdown at Invercargill.
22 March—Southland All Breeds at Invercargill

The Business Side Of Farming

The Farmer and His Employees

By H. H. TURNBULL,
Farm Advisory Officer (Economics), Department of Agriculture,
Palmerston North

FARM labour may be employed in many different forms; as a permanent worker, a casual worker, a contractor, a shearer, a sharemilker, or as a manager. For each there are laws and awards governing employment, conditions of work, rates of pay, and holidays, which are discussed in this article, one of a series on problems of farmers as businessmen.

THERE has been legislation covering farm workers since 1898, when Inspectors of Factories were given power to inspect shearers' accommodation. In 1907 the inspection of accommodation was extended to agricultural and pastoral workers by the Agricultural Labourers Accommodation Act.

The current legislation is the Agricultural Workers Act of 1936, which was introduced mainly to cover dairy farm workers but contained a section which enabled the provisions of the Act to be extended to cover other types of agricultural workers. This was done and Extension Orders now cover farms and stations, orchardists, market gardens, and tobacco growers.

Some protection was also given sharemilkers in 1937 by the Sharemilking Agreement Act, which set out standard terms and conditions of sharemilking for 29 per cent and 39 per cent agreements.

Agricultural Workers Act 1936

The Agricultural Workers Act 1936 still applies today and rates of pay are altered as necessary by Order in Council. Some provisions of the Act cover all the Orders and these are discussed first.

Accommodation

Under the Agricultural Workers Accommodation Regulations 1937 the employer must supply adequate and suitable accommodation, including sleeping quarters containing at least 500 cub. ft. of air space per person. Suitable furniture, a first-aid kit, and facilities for heating, lighting, ventilation, and sanitation must also be provided.

An employee cannot be charged for board and lodging. If it is not provided, the wages must be increased by £2 2s. 6d. per week. A sheep farmer may not charge rent for a house provided for an employee.

Holidays

Before an employee goes on any holiday exceeding three days all holiday pay must be paid at the same rates as ordinary working rates plus the rate specified for board and lodging.

Deductions from Wages

Only normal PAYE deductions can be made from the wages of an employee except for time lost by illness or default. Wages must be paid at least once every month.

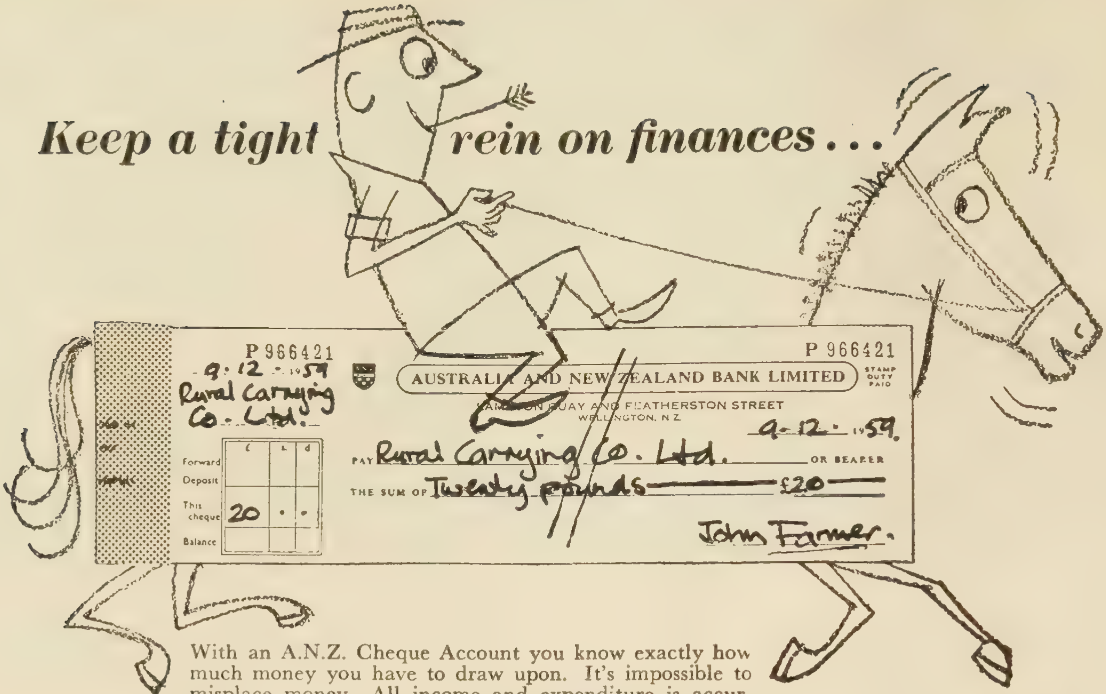
Permits to Accept Less than Minimum Wage Rates

An employee incapable of earning wages at the appropriate minimum rate may apply to the Department of Labour for a permit to accept wages lower than those specified in the Order. This enables persons who because of age or physical or mental disability cannot do a full day's work to be employed on a farm.

Records of Wages and Holidays

Every farmer who has employees must keep a record of the wages paid and the holidays allowed. The em-

Keep a tight rein on finances . . .



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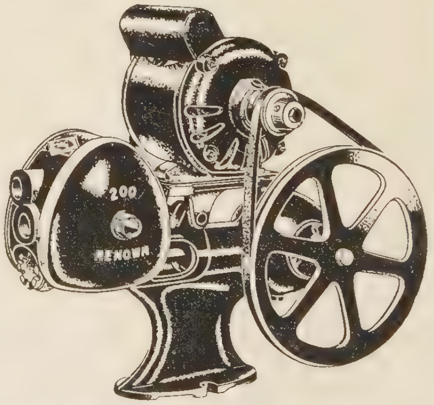

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TABLE I—RATES FOR CASUAL WORKERS ON DAIRY FARMS AND FARMS AND STATIONS

Harvesters, 5s. 4d. an hour with rations.

	By the hour		By the day	
	Found	Not found	Found	Not found
	s. d.	s. d.	£ s. d.	£ s. d.
Other workers				
18 years and upward	4 6½	5 4	1 16 4	2 2 6
Under 18 years	3 1	3 10½	1 4 10	1 11 0

ployee must sign the record and his signature is a receipt. The wages and holiday book for the two years before the date of inspection is to be made available to an inspector at all times.

Workers Compensation Insurance

The law requires every employer to insure against his liability to pay compensation.

Dairy Workers Wage Order

All the preceding provisions, except where specifically excluded, apply to workers on dairy farms, as do the following:

Children

A child under 15 years of age shall not be employed for hire or reward on a dairy farm.

Holidays

Every worker who has been employed for not less than four weeks shall be allowed a holiday of not less than seven days in the aggregate for every 12 weeks of employment and a holiday of a proportionate part of a week for every broken period of employment. The holiday is to be allowed at a time convenient to the employer, but not less than a total of 28 days shall be allowed during each year of employment. By agreement the worker may each week take a half-holiday, either from noon for the remainder of the day, or between milkings, in which case he must be allowed a further holiday of 14 days in the aggregate during each year of his employment, plus a proportionate part of a fortnight for every part of a year.

When a worker leaves all holidays or holiday pay due must be allowed or paid to him.

Pay for Casual Workers

Rates of pay for casual workers are given in Table 1. Allowance for holidays must be paid and the computation will depend on the length of employment.

Pay for Weekly Workers

Rates of pay for workers employed by the week are determined by the ages of the workers; the rates include an allowance for work done at weekends and on holidays as part of the normal week's work. The rates shown in Table 2 are the minimum rates that must be paid to dairy farm workers, with exceptions which are set out in the Act.

TABLE 2—RATES OF WAGES FOR WORKERS ON DAIRY FARMS AS AT JULY 1960

Workers	A week
	£ s. d.
(a) Under 17 years	4 10 6
(b) 17 years but under 18 years	5 13 3
(c) 18 years but under 19 years	6 17 9
(d) 19 years but under 20 years	8 1 0
(e) 20 years but under 21 years	9 3 3
(f) 21 years and upward	10 5 6

These rates include allowance for work done at weekends and on holidays as part of the normal week's work.

Farms and Stations Extension Order

The Agricultural Workers Act general provisions apply to the Farm and Stations Extension Order, as do the following:

Holidays

A worker is entitled to the seven statutory holidays, Anzac Day, and Anniversary Day or days in place of them as agreed to between himself and his employer. He is also entitled to another 31 days per annum as follows: Not less than 12 working days at one period at the convenience of the employer, the other 19 days to be taken as half-days, or at times agreed to between the employer and the worker. The total number of holidays must be not fewer than 40 per annum. Any worker whose period of employment is less than 12 months receives a proportion of the 31 days, according to length of service.

An alternative day off is to be allowed when work is done on a Sunday. This shall not apply to the milking of cows, feeding of stock, or lambing.

Under the Annual Holidays Act 1944 casual workers must receive holiday pay as described below, with the addition of the provision on statutory holidays as in paragraph (c).

(a) Where a worker, paid by the hour or the day, is employed for a period of **less** than three weeks, he shall be paid an additional amount equal to one twenty-fifth of the **actual** pay received by him during the period of employment.

(b) Where the period is **more** than three weeks he shall be paid an additional amount equal to one twenty-fifth of the amount of wages **normally** payable to him for the full normal working period concerned.

(c) Where a worker, paid by the hour or the day, is employed for more than one month he shall be entitled to full payment for each statutory holiday falling within the period of his employment.

Rates of Pay

Rates of pay are given in Table 3.

TABLE 3—MINIMUM RATES OF WAGES FOR WORKERS ON FARMS AND STATIONS

Workers	Per week and found
	£ s. d.
Under 17 years	3 8 3
17 years but under 18 years	4 7 9
18 years but under 19 years	5 7 9
19 years but under 20 years	6 8 6
20 years but under 21 years	7 11 0
21 years and upward	8 8 3

A worker provided with only lodging or a free house must receive £1 12s. 6d. per week extra.

Rates for Married Couples

When the wife does cooking or general farm work her wages shall be as agreed on.

Any dispute as to the rate shall be determined by an Inspector of Factories according to the Minimum Wages Act and Orders made under it which specify hourly, daily, and weekly rates for adult workers for whom no specified rates are provided. The present rates for females under this Act are: by the hour, 3s. 5d.; by the day, £1 7s. 4d.; by the week, £6 13s.

Shearers Award and Musterers, Packers, and Drovers Award

The first Shearers Award was introduced in 1902. The rates of pay for shearers are determined annually and are based on an index, fixed by a Committee, on the price of wool at the previous year's sales.

Farmers must employ only shearers or musterers, etc., who are members of the New Zealand Industrial Union of Workers.

The awards, which must be displayed, define most of the obligations of the farmer and the worker.

Shearers' Accommodation

The Shearers Accommodation Act 1919 and Regulations 1926 are still in force, and like the Agricultural Workers Accommodation Regulations lay down standards of accommodation for shearers. There must be 480 cub. ft. of air space for each person accommodated, and provision must be made for suitable lighting, heating, ventilation, sanitation, storage for meat and other perishable provisions, first aid appliances, washing and drinking water, and the drying of clothes.

Sleeping quarters must be separate from dining quarters, and there must also be enough furniture and necessary utensils.

Before the shearers are employed the quarters must be fumigated or disinfected, and the shearers must keep the quarters clean during occupation.

Shearers who wilfully damage accommodation can be fined and the Court can order compensation to be paid to the owner for any damage.

Sharemilkers

Three common types of agreement are in use today in sharemilking, the 29 per cent, the 39 per cent, and the 50-50. Standard terms and conditions for the 29 per cent and the 39 per cent agreements have been laid down in the Sharemilking Agreements Order 1951 and the Amendment No. 1 of June 1959.

Anyone who is considering entering into one of these agreements should get copies from the Government Printer (price, 1s. 3d., post free).

The 50-50 sharemilking agreement is a contract between two persons which by common practice follows a well defined pattern, but no statutory provisions for any terms or conditions are provided.

Contractors

Generally, for contractors it is necessary only to make the appropriate taxation deductions unless a certificate of exemption from the Inland Revenue Department is produced.

General

The Department of Labour is responsible for the administration of all the legislation mentioned in this article, and Departmental inspectors ensure that the legislation is complied with.

The article has not covered the full scope of the Acts and awards, but only some of the most important points. Any problems or queries associated with the legislation, or the employment of labour, should be taken to the local office of the Department of Labour, where advice and copies of the orders and awards are available.

Acknowledgment

The author acknowledges the considerable help given by the Department of Labour in compiling the information.

A Handy Dog Chain

A SHORT length of light dog chain with a spring snap hook at each end is used by G. Lock, of the Department of Agriculture's Animal Research Station, Wallaceville, for tying up his dogs when he is working round the yards or near the main road which bisects the Kaitoke farm of the Station.

The chains when not in use are worn by the dogs in addition to their ordinary leather collars and fit easily round their necks. The overall lengths of the chains and swivelling snap hooks on Nell and her daughter Jill in the illustration are 18 in. and 16 in.

These chains are safe to use, and as the dogs carry their own, are always readily available.

The dogs can be quickly chained to any fence without a chance of getting hung up and have plenty of freedom to move round and lie down comfortably out of harm's way.

Collars and chains are usually taken off at mustering.

The chains could be used on dosing strips.

—*G. L. WICKENDEN, Sheep and Wool Instructor,*
Department of Agriculture, Wellington

Book Review

"Maori Land Law": Judge Norman Smith

WHILE there are well known text books dealing with the various branches of law covering the land of pakehas, very little has been devoted to the land laws affecting the Maori people.

For this reason the recent book "Maori Land Law", by Norman Smith, a Judge of the Maori Land Court, will be particularly welcomed by members of the legal profession with Maori clients and by administrators and lessees of Maori land. However, the book deserves to be used as a reference by a wider range of readers than those directly interested in Maori land law.

The first chapter, covering the history of the Maori Land Court, is worth study by any student of Maori affairs, and those relating to marriage and the adoption of children give a background to some of the present-day problems associated with the use of Maori land. Judge Smith is to be commended for his painstaking and erudite work.

—*R.H.S.*

A. H. and A. W. Reed. 42s.

Transference of Fertility on Rolling Country

By A. V. ALLO,
Farm Advisory Officer,
Department of Agriculture, Tauranga

FOR many years transference of fertility has been a problem in the maintenance of soil fertility levels, up to the present being considered mostly on a farm scale, whereby fertility is taken from day dairy pastures to night paddocks and from hay and silage paddocks to other parts of the farm.

A TRANSFERENCE of fertility within a single paddock is also common; for instance, on most dairy pastures fertility is high round gateways and water troughs and alongside shelter hedges, because stock are inclined to hang round these places, which therefore receive more stock droppings than parts furthest away.

Rolling Country

Transference of fertility is also found on rolling country, being seen in paddocks with sidelings and flat tops. Fertility is slowly but surely taken from the sidelings to the flatter areas of the paddock.

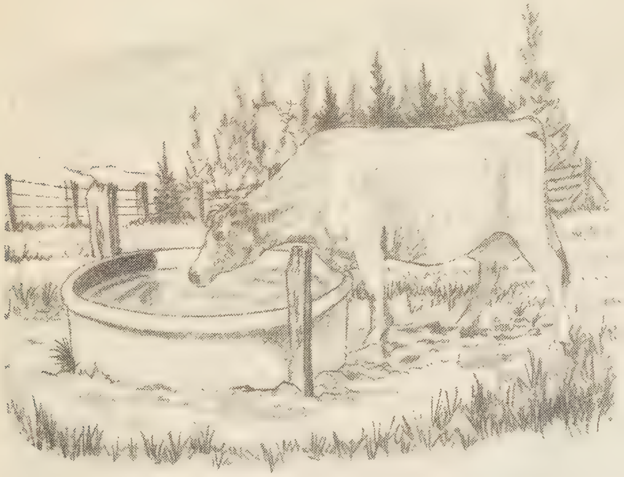
Ideally, such country should be contour fenced, with sidelings as separate paddocks from the flat tops, and this has been done on many farms.

However, it is not always possible to do this, because many hill country farms have been subdivided for a number of years, with hedges established along fencelines, and with areas subdivided into paddocks with sidelings and flats.

Refencing of such farms, especially when there are hedges, is usually out of the question because of the work involved and the cost. Also, there is not always sufficient sideling or flat to make a separate paddock, and it is then quite impossible to do other than include both in one paddock.

Sidelings and Flats

Transference of fertility can be serious in its effects on pasture quality and stock production. The grass in sidelings tends to get poorer and white clover weakens while the flats become excessively fertile, producing far more grass, which is frequently neglected by stock because of its low palatability.



Pasture species such as cocksfoot and Yorkshire fog are encouraged, and the sward tends to open up and become invaded with weeds, particularly chickweed (*Stellaria media*), Scotch thistle (*Cirsium lanceolatum*), and docks (*Rumex* spp.).

To overcome this fertility transference and so even out the pasture in the paddock it must first be appreciated that the fertility of the flat top is mostly extremely high, and that such an area is unlikely to respond to artificial fertilisers.

Why, then, topdress them every year? It is far better to topdress such areas every second or third year only, and in the interval apply all the fertiliser that usually goes on to the paddock to the sidelings only.

Use of Electric Fence

The farmer should endeavour to cash in on these high-fertility patches. One way is to use an electric fence and treat them as small breaks to be grazed separately. The surplus growth can then be kept under control and the pastures prevented from opening up so much.

Usually the areas of high fertility can be grazed twice as often as the rest of the paddock.

Sod Seeding

Such areas can be sod seeded with pasture species which will thrive under these conditions and which will remain palatable even when allowed to get away.

Two suitable species are Italian ryegrass and prairie grass, and both have been used successfully in Tauranga County.

If the area is sod seeded with a mixture of 6 lb of Italian ryegrass and 6 lb of prairie grass in autumn, there will be a marked thickening of the sward and increase in production.

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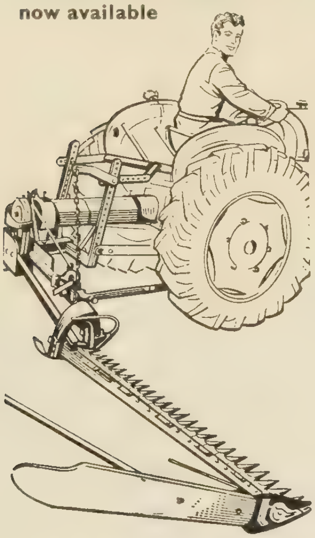

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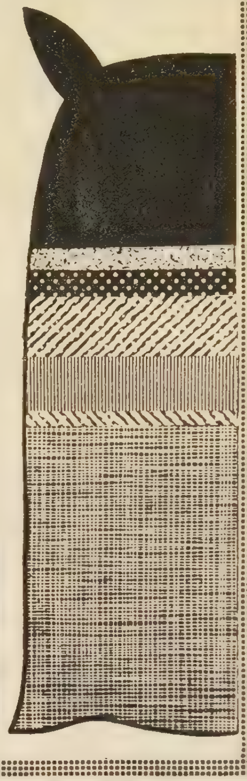
and in weighable quantities: MOLYBDENUM, COBALT, COPPER.



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1147

Tomoana FULL-FEED Dog Crackers

Tripod for Weighing Stock

By B. A. J. SMITH,
Fields Instructor,
Department of Agriculture,
Hawera

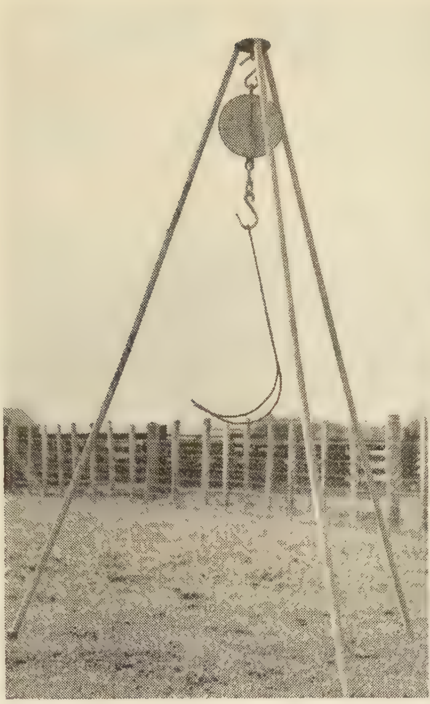
MOST farmers at some time need a simple means of weighing single animals or farm produce. Unless some convenient place is available from which to hang scales, weighing can be a laborious task.

The tripod described is cheap, portable, and suitable for weighing up to the capacity of a 200 lb set of clock-face scales. It can be used for weighing calves or sheep, fleeces, small lots of fertiliser, or crop produce. The tripod is of ¾ in. galvanised piping, and when assembled stands 7 ft high, with a spread of 5 ft between the legs on the ground. The calf hook suspended from the scales hangs to within 2 ft 6 in. of the ground. The total weight is about 30 lb, and the total cost for construction and material, excluding scales and calf hook, is a little over £4.

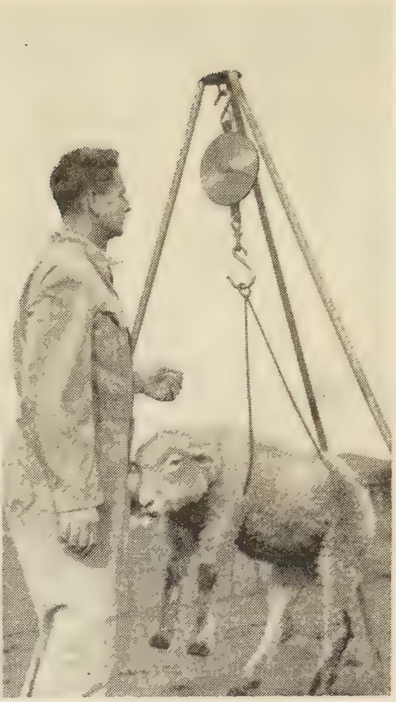
Construction Details

Each of the three legs consists of two pieces of piping each 3 ft 9 in. long. The lower end of the bottom section has a short pointed length of ¾ in. round steel rod welded to it to provide a firm footing. The lower end of the top section has a 3½ in. length of similar rod welded to it so that when assembled it slips inside the top of the lower section. The weight of the whole assembly keeps the sections together.

The top is a 4 in. diameter circular steel plate with three ¾ in. round steel rods, each 5 in. long, welded to it at angles to allow for the spread of the legs. A U hook from which the scales are suspended is welded to the centre of this circular plate.

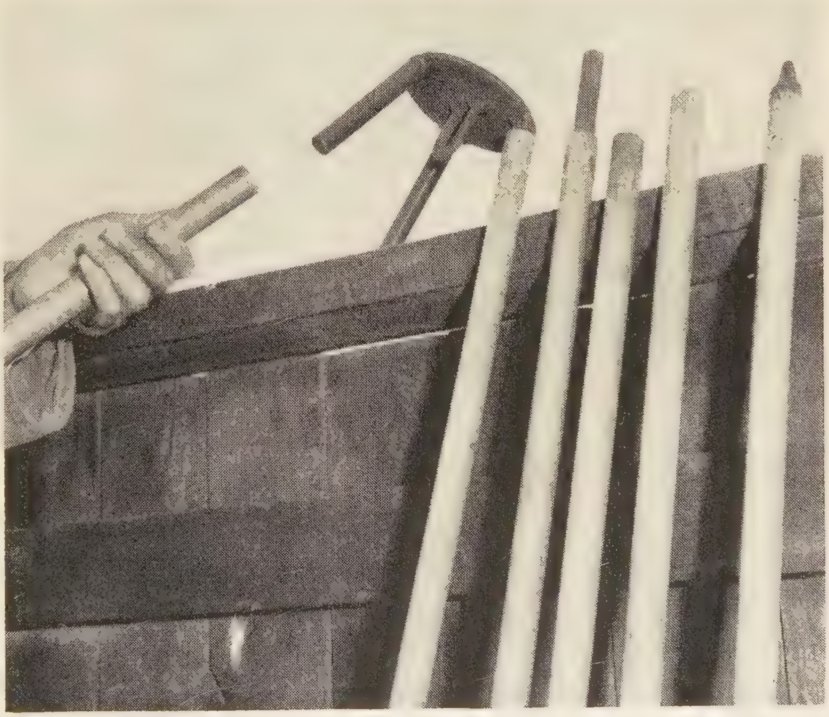


The tripod and scales assembled for use.



Weighing a sheep, showing method of holding the animal on the hook.

▼ Parts of the tripod.



DEAD - but they won't lie down

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H21/59

Celery Varieties Treated with Gibberellic Acid

By A. B. WEBSTER,
Scientific Officer, Department of Agriculture Horticultural Research Station, Levin

EIGHT varieties of green celery and two self-blanching varieties were tested at the Department of Agriculture's Levin Horticultural Research Station during 1959-60. The green varieties cropped more heavily and were of better quality than the self-blanching types. The best varieties of those tested were Tall Utah 52-70, Slowbolting Green 12, and Utah 15. Gibberellic acid increased the length of the stalks, but tended to reduce the yield of salable produce.

SEED which had been supplied by the Ferry Morse Seed Co. of California, U.S.A., was sown in boxes of John Innes Seed Compost on 1 September in a heated glasshouse. Seedlings were pricked out at 2 in. centres into John Innes Potting Compost No. 1 on 23 September and transferred to a cold house. Later they went out into frames. The loam for the composts had been steam sterilised. Previous experience with loam sterilised with methyl bromide in John Innes composts had shown that this was not suitable for celery.

On 11 and 19 November, when the plants were about 5 in. high, they were planted in two-row "beds" 3 ft from centre to centre, with rows 6 in. apart and the plants staggered 12 in. apart.

Fertiliser Applied

About 30 tons per acre of straw compost had been worked into the soil and enough ground limestone applied to bring the pH up to 6.2. A mixture of 5 parts of superphosphate and 3 parts of sulphate of ammonia was worked into the soil at 8 cwt per acre just before planting. After three weeks, when the plants were beginning to grow away strongly, topdressing at weekly intervals began. A mixture of 3 parts of dried blood and 1 part of sulphate of potash was applied at 5 cwt per acre each week until the beginning of February.

The plants were watered in with overhead irrigation equipment and were given a thorough soaking every week unless there had been heavy rain.

This treatment produced plants ready for harvesting by the end of February. They were up to 3 ft tall and weighed up to 7½ lb each untrimmed.

Gibberellic Acid Treatment

The gibberellic acid was applied to half the plots on 9 February—three weeks before harvesting on 29 February and 1 March. Work in other countries has shown that this is the most effective time to apply it. Application was by knapsack sprayer at 1 oz of gibberellic acid in 150 gallons of water per acre. The control plots were sprayed with water at the same time.

At harvest the roots were cut just below soil level with a heavy knife and the plants were then weighed and their length measured. They were also examined for colour, number of side shoots, signs of bolting, and rotting. The texture of the stalks was judged by the ease or otherwise of snapping one of the stalks on each plant and by the presence or absence of strings.

Yield figures in the table relate to plants complete with side shoots and outer leaves which would be removed before sale. Total yields include rotted plants, but salable yields include only healthy plants.

Effect of Gibberellic Acid

Gibberellic acid increased the length of the stalks of all varieties by an average of 1.8 in. per plant. However, it also increased the tendency of susceptible varieties to rot in the centre, with the result that it reduced the salable yield of these varieties. Varieties which are not susceptible to this trouble and which benefited from the application of gibberellic acid were:

Slowbolting Green 12
Slowbolting Green 13B
Summer Pascal-Waltham strain
Pascal 259-19

It is doubtful if the higher price obtained for the slightly longer stalks would compensate for the cost of material and its application. Better results may be obtained when growing conditions are less favourable.

Notes on Varieties

(In Order of Merit)

Tall Utah 52-70: The tallest variety in the trial. A heavy cropper but rather susceptible to heart rot. Leaves very finely divided—distinctive. Stalks pale green and tightly packed round stem. Good crisp texture.

Slowbolting Green 12: A tall plant and heavy cropper of good texture. Stalks packed closely together. Not susceptible to bolting or to heart rot. Produced the fewest side shoots of any variety in the trial. Responds satisfactorily to gibberellic acid.

Utah 15: Very tall plants with stout pale green stems. A heavy cropper, with stalks fairly tightly packed together. Good texture. Slightly susceptible to heart rot and to bolting. Slow growing in the propagation stage.

Slowbolting Green 13B: A shorter plant which produces a heavy crop. Responds satis-

YIELD, PLANT HEIGHT, AND QUALITY OF CELERY

Variety	Yield in tons per acre Salable	Yield in tons per acre Total	Plant height in.	Colour score*	Texture score†	No. of side shoots per plant	Bolters per cent	Rotten per cent
Utah 15	52.0 a‡	55.3 abc	35.8 b	2.0	3.6	3.0	7.3	4.7
Tall Utah 52-70	55.5 a	62.6 a	36.7 a	2.0	3.5	3.2	2.7	10.7
Slowbolting Green 13B	58.2 a	58.6 ab	31.8 e	2.0	3.4	4.2	0.0	0.0
Slowbolting Green 12	57.0 a	57.8 ab	34.2 c	2.0	3.5	3.6	0.0	1.3
Summer Pascal-Waltham Strain	48.0 a	48.0 cd	30.5 f	2.0	3.1	3.5	0.0	0.7
Earligreen	49.0 a	53.8 abc	30.5 f	2.0	2.9	4.0	1.3	11.3
Pascal 259-19	38.4 b	38.5 e	29.8 f	2.2	3.5	3.3	12.7	0.0
Tall Utah 10B	32.2 b	41.2 de	32.7 d	2.0	3.5	3.4	27.3	14.7
Golden Plume	48.3 a	50.0 bcd	34.2 d	3.0	2.8	3.4	2.0	4.7
Cornell 19	16.9 c	19.0 f	29.0 g	3.0	3.5	2.9	54.6	4.7
Control	47.6 a	48.9 a	31.6 b	2.2	3.4	3.5	10.0	2.7
Gibberellic acid	43.4 b	48.0 a	33.4 a	2.2	3.3	3.4	11.3	7.4
Coefficient of variation	14.8%	10.8%	3.3%					

* 2.0, pale green; 3.0, cream

† 1, very poor; 3, medium; 5, very good

‡ Varieties or treatments with the same letter are not significantly different at the 5 per cent level

factorily to gibberellic acid. Good texture. Not susceptible to heart rot or to bolting. Stalks rather loosely packed together. Market appearance not neat.

Summer Pascal-Waltham Strain: A rather shorter, stout plant. Heavy cropper. Not susceptible to heart rot or to bolting. Stalks thick and fairly well packed together. Texture fairly good. Responds satisfactorily to gibberellic acid.

Earligreen: A shorter variety that crops heavily. Base of plant broad and stalks not very tightly packed. Very few bolters. Susceptible to heart rot. Texture fair, the poorest of the green varieties.

Pascal 259-19: A shorter, fairly stout plant. Moderate cropper. Texture good. Not susceptible to heart rot. Slightly susceptible to bolting. Stalks fairly tightly packed together.

Tall Utah 10B: Tall, stout plants of good texture. Moderate cropper. Very susceptible to heart rot and to bolting. Outer edges of the leaves chlorotic.

Golden Plume 4162: Tall, stout sticks of the self-blanching type. A heavy cropper only slightly susceptible to heart rot and bolting. Texture rather poor.

Cornell No. 19: The shortest plant and poorest cropper in the trial. Plants very slender. Texture good. Very susceptible to bolting and slightly susceptible to heart rot. Slow in the propagating stage.

Green Varieties Best

The green varieties were much preferred to the self-blanching types. They cropped more heavily; were longer in the stalk; were of better texture and flavour, and were generally less susceptible to heart rot or to bolting than the self-blanching varieties. Though of good fresh appearance, they could well **appear** to be coarse and immature to eyes accustomed to the creamy whiteness of the self-blanching varieties, but there is no trace of coarseness, stringiness, or bitterness when they are eaten.

◆

"Black Seed" Disease of Strawberry Fruit

STRAWBERRY leaf spot, caused by the fungus *Mycosphaerella fragariae*, is probably the most common fungous disease attacking strawberries in New Zealand. It is easily recognised by the small, reddish purple spots on the older leaves, which as they enlarge turn grey or white and are surrounded by a reddish margin. Normally this is not a serious disease provided reasonable control measures are taken, though in severe cases it can reduce the crop appreciably because of the loss of valuable leaf area.

Last year this disease was identified as attacking strawberry fruit in South Canterbury. This is the first time this peculiar form of the disease has been identified in New Zealand. It was first reported in Maryland and North Carolina (U.S.A.) in 1938 and given the name "black seed" disease.

Affected Fruit is Second Grade

In black seed disease the tiny achenes (seeds) are dark brown or black and are surrounded by a hard, brown, leathery lesion which seriously detracts from the appearance of the fruit. No rot appears and there is no apparent loss in crop yield, but there is a loss in income, as the resulting fruit is second grade and suitable only for jam.

The disease travels to the achenes through the stigma at flowering time. The fungus thus finds its way not only into the soft tissue of the unripe achene but into the soft flesh of the surrounding berry. The disease has been noted only on the late summer crop and only on varieties, such as Talisman, which are particularly susceptible to leaf spot.

Control Measures

Control measures should be based on reducing leaf spot to a minimum, as leaf spot is considered to be the major source of infection of the fruit. Leaf spot is controlled by reducing the carry-over from one crop to the next by removing and burning diseased leaves and by spraying during the growing season with a fungicide.

Bordeaux mixture (3 : 4 : 50) is the most efficient fungicide for leaf spot control. Because of its hardening effect on growth and its incompatibility with the organophosphorus systemic insecticides now in common use, bordeaux should be used only in early spring up to October.

Thiram 80 per cent (at 3 lb per 100 gallons) has proved the best alternative and should be applied at four-week intervals except during the flowering and picking period. No thiram should be applied during picking or for the seven days before because of the danger of the residue exceeding the tolerance allowed.

During the flowering period thiram is applied every 10 to 12 days. This is mainly against botrytis, but it should also give some control of black seed disease.

Control in planting material is obtained by dipping plants in a 4 : 4 : 50 bordeaux mixture plus a sticker (white oil 1 : 200). If foliage is scythed off between crops and taken away and burnt, and if the plants are sprayed regularly during the growing season, leaf spot and hence black seed disease should not cause trouble.

—M. A. NICHOLS, Horticultural Advisory Officer,
Department of Agriculture, Oamaru

Proper Use of Chemicals for Control of Weeds

USERS of chemical weedkillers or those contemplating their use, will find the new edition of the Department of Agriculture's Bulletin No. 329, "Chemical Methods of Weed Control", a practical guide in this modern, rather difficult field. Weed control methods have advanced rapidly in recent years and new materials with new qualities are continually appearing on the market. Expert advice on their use is set out clearly by L. J. Matthews, Principal Scientific Officer, Department of Agriculture, Wellington, in this latest edition of the bulletin.

So many weed problems exist in New Zealand that many different weedkillers are required and the tendency is to have a specific weedkiller for the control of a specific group of plants. Often when it is desirable to eliminate all vegetation, or all but one species, such as with crops, a combination of weedkillers is required.

The use of weedkillers depends on, in order of importance:

1. Determining the correct type of material or materials for a specific purpose.
2. Determining the correct stage of growth or time of application of the weedkiller.
3. Securing complete foliage cover or even distribution of the weedkiller.
4. Determining the right rate of application.

All these factors are dealt with in detail in the various sections which comprise: Principles of weed control, chemical weedkillers and their properties, control of specific weeds, weed control in specific areas, and application of weedkillers.

The bulletin, of 200 well-illustrated pages, including 12 pages of coloured illustrations of major weed species, is available at 3s. a copy from offices of the Department of Agriculture.

◆

Turnips as Winter Feed for Hoggets

▲ Hoggets on turnips in Southland.

TURNIPS are important for winter feeding in Otago and Southland, where they are valued for their reliability and their carrying capacity. Suggestions, none of them novel, on the utilisation of the turnip crop as a feed for hoggets arise from the results of four trials at the Department of Agriculture's Invermay Research Station, details of which were given in a paper by K. H. C. LEWIS, Scientific Officer, Invermay, at the annual farmers' conference. This article is an adaptation of the paper.

THE rearing of hoggets will probably always present some problems. As autumn passes into winter hoggets must continue steady growth though their general environment is deteriorating. Feed is becoming less abundant and less nutritious. Exposure to parasites and bacterial infections and to stresses of cold, wetness, and reduced sunlight increases. All challenge in turn the hogget's developing constitution.

The basis of defence is well known. Good feeding enhances resistance to the effects of severe climate, to parasitism, both internal and external, and to some bacterial and virus diseases. Though poorly fed animals are predisposed to disease through lowered resistance, apparently well fed animals may fail to thrive because of specific deficiencies of vitamins or trace elements in the diet. In spite of the treatment or elimination of known deficiencies lack of thrift may persist and we are left with the notorious ill thrift.

It may be argued that the rigours of winter assist in the selection of hoggets best fitted by constitution to enter the breeding flock. It is doubtful if poor rearing increases the efficiency of that selection. Poor rearing results in loss of production and death. Death closes the account, but it is probable that the effects of poor winter feeding which are reflected in retarded growth can to some extent be overcome by subsequent favourable conditions. With spring growth and warm weather hoggets can be expected to thrive.

Investigations have shown that where hoggets were very poorly fed in winter but subsequently favoured, wool and milk production in later years was unaffected. Minor effects on fertility only were noted, but some loss of longevity as assessed by tooth wear was apparent. Though these consequences do not add up to a compelling need for good rearing, the immediate productivity and lower mortality of well reared hoggets are of substantial importance to a large sheep industry.

Hogget Rearing

In late summer and autumn lambs yet to be fattened get first preference in the grazing available. Ewe hoggets are next in importance. With feed requirements for ewes greatly reduced after weaning it is usually not difficult to provide good pasture and favourable conditions for growth. When pasture growth ceases hoggets must be put on to supplementary feed so that they continue to make growth. Common feeds are chou moellier, kale, turnips, and cereal green feeds with or without hay.

Invermay Trials

The trials with hoggets at Invermay were based on feeding of white-fleshed turnips and lucerne hay, with and without calciferol. The food value of these is now considered briefly.

Turnips

Turnip crops vary widely in quality because of growing conditions and disease. They are low in dry matter, protein, and fibre and from analysis do not appear suited to the needs of young growing stock. Dry matter content and dry matter yield per acre are important in assessment of food value of a crop.

Both turnips and swedes yield relatively highly in dry matter per acre and their carrying capacities are accordingly high. The rate of gain on these crops, however, is low and in some systems of management negligible, because the dry matter content is too low to meet the nutritional requirements for growth or weight increase within the limits of the animals' appetite.

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Turnips a Satisfactory Feed for Hoggets; Hay Supplement Has Some Advantages

THE results from the trials described in this article seem to justify the following recommendations:

- Turnips alone can provide a satisfactory diet for hoggets, though most authorities and many farmers are reluctant to sanction this as a rule. Because of their low dry matter content turnips must be consumed to the limit of appetite. This can be done only by continuous feeding. Restriction of intake by the use of runoffs will reduce live-weight gains.

- Good hay can be used to provide a varied diet and can be fed freely or in limited quantities. No increase in live-weight gain can be expected from its use unless the turnip crop has deteriorated owing to disease. A saving of turnips will result from the use of hay, and this may be valuable where the crop is below requirements.

- Average quality or poor hay if eaten in sufficient quantities will probably depress live-weight gains. Hay of this type should not be used where turnips are plentiful.

Live-weight gains resulting from the various ways of using the turnip crop have not differed greatly (except in Trials 1 and 2). It is reasonable to suppose that both the immediate and future productivity of the hoggets has been unaffected by the feeding systems. Unlike fat lamb production, where extra gain means extra production, any system of hogget rearing which fulfils the general requirement of steady growth to maturity can be regarded as satisfactory. Turnip feeding in its various forms appears to meet this requirement.

Turnip tops are higher in dry matter, protein, and fibre than bulbs and as a result have a higher feeding value. White-fleshed turnips grown for lamb fattening are satisfactory while tops are available. The bulbs, however, do not support an adequate rate of gain. This is recognised in systems of hogget feeding in which the tops are grazed by hoggets before the crop is fed to ewes.

Lucerne Hay

Hay can be extremely variable in quality, but usually contains about 80 to 85 per cent of dry matter. Lucerne hay is highly regarded and is generally superior, particularly in protein, to meadow hay unless the latter contains a high proportion of clover.

Hay is fed to provide energy at a maintenance level. Hay alone can suffice if it is of high quality, but often its quality is insufficient to maintain body weight and it is then used with some more nutritious supplement, usually roots, to provide a satisfactory ration.

Calciferol

Calciferol is a form of vitamin D, which is essential for bone formation and hence of great importance for growing animals. Exposure to sunlight will provide some vitamin D, but in the absence of dietary vitamin D bone formation is often imperfect. Feeds exposed to sunlight, such as hay, contain vitamin D.

Details of Trials

The four trials were conducted in successive winters with N.Z. Green Globe turnips. With the exception of Trial 1 all crops were sown on newly broken hill country before the establishment of permanent pasture. Treatments in which hoggets had access to turnips unfenced from rough grazing resulted from the utilisation of such crops in the early stages of land development.

All trial groups comprised 25 or 30 hoggets.

Trial 1

This trial investigated the effect of calciferol on winter live-weight gains. Hoggets treated at the beginning and after six weeks' feeding with doses of 1 million international units of calciferol were compared with undosed controls. Turnips were grazed for five hours daily, after which the stock were turned into a bare runoff where average-quality lucerne hay was fed freely. Following a suggestion that lucerne hay and the existing pasture might provide a limited but useful source of vitamin D, two further groups were added, both receiving an exclusive diet of turnips with and without the two doses of calciferol. No runoff was provided. Two breaks of turnips were fed in the total feeding period of nine and a half weeks.

Live-weight gains at the end of the period were:

	lb
Turnips alone	+12.5
Turnips + calciferol	+14.6
Turnips and hay	—4.4
Turnips and hay + calciferol	—3.7

Calciferol thus increased live-weight gain by about 2 lb where turnips alone were fed, but was without effect with the hay supplement. There was a difference of 17½ lb between the two major feeding systems, those being runoff daily actually losing weight over the trial period.

Trial 2

Two changes were made in the feeding systems in this trial. One group again received turnips only. Restricted turnip feeding with paddock runoff was replaced by free access to rough hill grazing, giving a choice or voluntary runoff on to roughage but without a hay supplement. The other change was to feed hay freely on the turnip break but without runoff. In this group hay consumption was low while turnip tops were available, but rose to a stable figure of about 1 lb per head per day after one month. In the total feeding period of 12 weeks it averaged 0.8 lb per head. Two breaks of turnips were fed. Calciferol was not used.

Live-weight gains by the end of the period were as follows:

	lb
Turnips alone	21.4
Turnips + hay	14.4
Turnips + roughage	8.9

Unsupplemented turnips were again superior. Hay fed on the break reduced the rate of gain, but was a better supplement than roughage.

Trial 3

To investigate the possibility that a limited increase in the fibre content of the diet might be beneficial, Trial 2 was repeated with the addition of two groups on restricted supplements. Lucerne hay or crushed oats were each trough fed at ¼ lb per head per day to hoggets confined on turnips. At this level of feeding the essential nature of the turnip diet was not greatly altered.

It was decided to reduce the size of the breaks so that tops were fed more frequently. Five breaks were used, lasting 13, 14, 16, 24, and 22 days respectively, a total of about 12½ weeks. All groups were shifted on the same day. A considerably longer period was required to eat out the last two breaks. Though this may have been due to a heavier crop, it is certain that intake dropped as a result of a decline in the quality of the turnips. Soft rot was prevalent and many bulbs had become pithy. Hay was of very high quality and as consumption rose quickly to 2 lb per head daily, it was restricted to bring consumption into line with that of earlier trials. Daily consumption averaged 0.9 lb per day.

Half of each group, with the exception of those on roughage, was dosed with 1 million units of calciferol at the start of the feeding period.

Live-weight gains by the end of the period were as follows:

	lb
Turnips alone	7.5
Turnips + hay	8.0
Turnips + ½ lb hay	10.4
Turnips + ¼ lb oats	7.6
Turnips + roughage	7.3
Calciferol (all treatments)	8.4
No calciferol (all treatments)	8.3

Growth rates were similar on all feeds except the low rate of hay, which was 2½ lb better. As individual weight gains within any one treatment were very variable (from +21 lb to —4 lb), it is difficult to attach significance to this apparent superiority. Calciferol was without effect in any treatment.

Trial 4

This trial repeated Trial 3 except that calciferol treatments were omitted. Lucerne hay was of medium to good quality and daily consumption averaged 0.8 lb per head daily. Two turnip breaks were fed, the first lasting six weeks and the second three weeks.

Live-weight gains by the end of the period were as follows:

	lb
Turnips alone	11.7
Turnips + hay	9.8
Turnips + ½ lb hay	8.2
Turnips + ¼ lb oats	8.7
Turnips + roughage	8.3

Growth rates were again essentially similar with again a suggestion of superiority in the turnips-alone diet.

Though differences in live-weight gain due to the various treatments have been variable, they are consistent with the following suppositions:

1. Turnip bulbs alone can supply sufficient nutrients for a modest rate of growth where management and quality permit full appetite to be satisfied.
2. Lucerne hay, though providing adequate protein for growth, contains sufficient energy for maintenance only when consumed at the limit of appetite.
3. The replacement of part of the turnip intake with lucerne hay will lower the total energy value of the diet, though the protein content may be increased.

The first supposition is supported by all four trials, where live-weight gains on turnips alone have with one exception exceeded 1 lb per week. The maximum gain on turnips alone of 0.25 lb daily was about three times the minimum gain (0.08 lb daily). This difference is attributed to turnip quality and its effect on intake.

In Trial 3 dry and soft rots were severe in the latter stages. However, where intake and the food value of that intake was limited by deterioration in the crop, supplementation did not improve the position.

Full intake of turnips appears necessary for good growth rates. These can be achieved only where intake is spread over 24 hours and appetite can be satisfied as it recurs.

On the one occasion (Trial 1) where hoggets were restricted in their intake they lost weight. In this instance the five hours spent on turnips were probably only as effective as the time necessary for the hoggets to graze their fill.

The second supposition is based on calculations of the average feeding values of lucerne hay and the recognised maintenance and productive requirements of sheep derived from feeding trials.

Even at a theoretical maximum rate of consumption of 3 lb per day for sheep of 70 to 80 lb bodyweight, good lucerne hay meets maintenance requirements only, with no surplus nutriment for weight increase. Such hay can, however, be relatively high in protein and when fed with turnips can increase the total protein intake.

The offering of hay on the turnip break has consistently resulted in an intake approaching 1 lb daily. An appreciable part of the dry matter appetite of the hogget (estimated at a third) is being satisfied by a feed which can be expected to maintain live-weight only. If average food values are assumed, total energy intake can be calculated to have been reduced by between 10 and 20 per cent. This is reflected in the live-weight gains in Trials 2, 3, and 4. In Trial 3, where hay quality was very high and turnips had deteriorated, live-weight gains tended to favour the hay supplement.

In treatments where a choice of diet was available (unrestricted hay supplement or free access to roughage) individual gains within groups were very variable, suggesting wide individual variation in the choice of the components of the ration.

Fibrous Feed

Fibre is widely held to be beneficial in the diet of sheep. Fibrous feeds are less readily digested, and the dry matter of turnips is considerably more digestible than that of lucerne hay, a fact associated with the wide difference in fibre content. The feeding of a limited hay ration raised the fibre content of the turnip diet about 50 per cent without greatly altering its nutritive value. The results of this addition are inconclusive.

Little can be said to justify the use of crushed oats. Pound for pound oats contain half as much energy again as lucerne hay but less protein and fibre

Little difference in fibre and total energy intake resulted from the inclusion of a limited oats supplement. Crushed oats may be useful where good hay is not available and some compulsion is felt to provide a varied diet, but the results of these trials do not suggest that they are useful in hogget feeding.

Stock mortality throughout the series of trials was negligible. Several hoggets were lost through blackleg infection, but its incidence was not associated with feeding treatments.

◆

Meteorological Records for October

Station	Height of station above M.S.L. (ft)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	240	57.9	+ 1.1	73.0	41.7	4.57	12	+ 0.06	2.00	4	210
Auckland	160	59.2	+ 1.8	71.3	47.2	3.86	10	— 0.23	0.91	5	230
Tauranga	12	57.0	+ 1.0	70.7	42.1	6.51	12	+ 1.54	4.51	5	224
Ruakura	131	55.7	+ 1.4	70.9	36.8	2.75	12	— 1.38	0.53	6	220
Whakarewarewa	1,006	54.8	+ 1.8	71.2	35.4	3.41	14	— 1.97	0.73	30	183
Gisborne	14	56.4	+ 0.9	72.9	38.5	1.96	15	— 0.47	0.56	5	236
New Plymouth	160	56.4	+ 2.0	69.0	41.2	3.11	16	— 2.52	0.64	29	211
Karioi	2,125	50.6	+ 2.4	67.5	31.0	2.20	16	— 2.05	0.37	11	
Napier	5	58.0	+ 1.5	77.5	40.9	0.80	8	— 1.10	0.20	30	227
Wanganui	72	57.0	+ 2.2	72.1	41.6	2.20	8	— 1.02	0.70	11	211
Palmerston North	110	55.8	+ 1.9	70.7	36.5	2.08	16	— 1.48	0.51	30	168
Waingawa	340	53.6	+ 0.9	75.0	33.4	2.46	10	— 0.50	1.16	30	214
Wellington	415	55.4	+ 2.6	66.8	42.3	3.67	12	— 0.56	0.87	30	208
Nelson airfield	5	55.9	+ 3.7	74.2	39.4	2.34	13	— 1.00	0.76	5	226
Blenheim	14	56.8	+ 3.1	75.1	35.7	1.55	7	— 0.65	0.75	13	200
Hokitika South	15	53.7	+ 2.7	67.9	37.2	9.70	16	— 1.32	1.94	7	180
Hanmer Forest	1,270	52.2	+ 1.6	72.5	29.5	3.77	12	— 0.13	1.40	29	187
Christchurch	22	54.8	+ 1.7	78.2	35.8	1.50	8	— 0.45	0.47	29	161
Ashburton	323	54.8	+ 2.4	83.6	33.2	2.03	7	— 0.39	0.83	13	163
Timaru	56	54.8	+ 2.1	75.7	31.2	2.56	10	+ 0.63	1.07	13	172
Alexandra	520	55.7	+ 3.3	77.0	31.2	0.75	5	— 0.47	0.41	29	203
Taieri	80	53.3	+ 2.3	79 8	33.7	1.24	11	— 0.82	0 43	13	156
Invercargill airfield	0	51.9	+ 2.9	73.9	33.6	1.56	13	— 1.92	0.37	28	165
Chatham Island	150	51.9	+ 2.0	62.1	37.0	1.67	17	— 0.26	0.90	14	

Vegetable Growing for HOME and MARKET GARDENERS

By the
HORTICULTURE DIVISION

Beans

THOUGH beans are not a main feature of the national diet in New Zealand as they are in many countries, the crop is still an important one for home gardeners, market growers, and process growers. Those commonly used include french beans (*Phaseolus vulgaris*), runner beans (*Phaseolus multifloris*), and broad beans (*Vicia faba*). French beans may be either dwarf or pole types. Lima beans (*Phaseolus lunatus*) are grown to a limited extent and soya beans (*Glycine max*) have been tried on an experimental scale. Yields from trials conducted over 20 years ago were very erratic and generally rather low. There has been renewed interest in soya beans in recent years and further trials with newer varieties are being carried out.

THE frost tender french and runner beans are not used as extensively or for such long periods in the colder parts of the country as they are in warmer areas. Broad beans are overwintered for spring and early summer use in all districts and they may also be sown in early spring.

Beans for Processing

Vegetables for canning and freezing are now an important part of the vegetable growing industry in New Zealand. Though peas account for more than half the acreage of processing vegetables, beans are a major crop also and about 1,000 acres of french beans are grown each year for canning and freezing. In recent years the area of broad beans for processing has increased and this crop is proving very useful in lengthening the season for processing factories.

As with most processing crops the largest centre of production is at Hastings, but other important areas producing beans for processing include Pukekohe, Gisborne, Nelson, Motueka, Blenheim, Christchurch, and Timaru. Though some very high yields of beans have been recorded in the Hastings district—up to 9 tons per acre for dwarf beans and 14 tons per acre for pole beans—usually yields are about 3 tons per acre for dwarf beans and 8 tons per acre for pole beans.

Bean Varieties

French beans are annuals.

Flat or round-podded varieties are available in dwarf and climbing varieties of french beans. There are many seed colours in french beans, but most varieties are classified according to their pod colour, which is usually green or yellow, though some mottling or flecking may occur. Yellow-podded varieties are known as wax or butter beans.

Many older varieties of french beans are still firm favourites with some home gardeners and to a less extent with market growers. Such varieties include Canadian Wonder and Pencil Pod Black Wax, both of which were introduced to the seed trade before 1900. The elimination of strings was the chief objective of the early bean breeders, many of whose varieties, including Burpee Stringless Green Pod and Pencil Pod Black Wax are still grown today.

Masterpiece, The Prince, Tendergreen, and Black Valentine have all been used in New Zealand for many years and have proved most successful. The first two have flat pods and the last two round pods.

The main attributes of Canadian Wonder are its tolerance to a wide range of growing conditions and its ability to crop well for a long period. It is a successful home garden variety if the beans are picked before strings develop.

Beans for processing require different qualities. High yield is important, but a short harvesting season is required, particularly if mechanical harvesting is to be used. Beans for processing must be stringless and snap cleanly. Blunt-ended pods are preferred because there is less wastage in topping and tailing. White-seeded beans make a more attractive product and for this reason varieties such as Processor and Bush Harvester have replaced Tendergreen, Tenderlong, Topcrop, and other varieties which

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were grown for processing a few years ago.

Butter Beans

Butter beans are popular in home gardens and are also grown for market. The two main types are: flat-podded varieties such as Golden Wax and more recently, Cherokee, and round-podded varieties which include Pencil Pod Black Wax, Brittle Wax, and Kinghorn. The last is now widely used as a processing bean in the U.S.A.

Pole Beans

Kentucky Wonder and the semi-dwarf variety Epicure are old varieties of pole beans. For many years the standard pole bean for market and home garden has been Fardenlosa, also known as Market Wonder or Golden Harvest. The origin of Fardenlosa is obscure, but it may have been derived from a German variety called Delicious.

D. E. Yen, of Crop Research Division, Department of Scientific and Industrial Research, has developed a shiny-podded strain of Fardenlosa. The original shiny-pod selection was obtained from a market gardener and the strain now available was developed from this. Both Fardenlosa and Shiny Fardenlosa are white-seeded and bear good crops of straight, fleshy, stringless, medium dark-green pods 7 to 9 in. long. The only difference between the two strains is the shiny pod characteristic.

French beans in the Auckland district are sown from the end of August to mid February. In wet seasons, in particular, late sown crops are liable to be severely attacked by bean rust disease. This disease is sometimes troublesome in other North Island areas and at Nelson and Motueka. Westralia, a white-seeded pole bean bred by Cass Smith of the Western Australian Department of Agriculture, has proved to be most successful as a late-sown bean where bean rust is troublesome.

Trials by Crop Research Division and Horticulture Division officers have shown that Westralia produces lower yields than Fardenlosa where rust is not a problem. In a bad season for rust, however, Westralia has yielded much heavier crops than Fardenlosa.

The rust resistance of Westralia is being incorporated into Fardenlosa and Shiny Fardenlosa varieties in a breeding programme at the Vegetable Research Station of the Crop Research Division at Otahuhu. Recent selections within Westralia have produced a smoother type of pod. Earlier strains of this variety were inclined to have rather lumpy pods.

The standard pole bean for processing is Blue Lake. There are a number of strains of this excellent pole bean on the market and though other varieties of pole beans have been used for processing in the past, Blue Lake is

Using a Bumper Crop of Beans

BOTH french and runner beans at times yield unexpectedly large crops which sometimes pose a problem for the thrifty homemaker. One of the oldest ways of using a bumper crop of beans is to salt them. Butter beans are not usually a success preserved in this way, but salted runner beans retain their colour, and their flavour and texture compare very favourably with those of freshly cooked beans. French beans are better frozen or canned.

Salted Beans

4 lb of freshly picked beans

1 lb of preserving salt (iodised salt may cause a brown layer to form on the top of the beans which, though unsightly, is not harmful)

Use only the finest quality, freshly picked beans. Wash them, remove the strings, and slice them. Place the beans and salt in alternate layers in a stone or earthenware crock, making the bean layers about 1 in. thick and the salt layer about ¼ in.

When the crock is full or when the beans are used up, put a plate on the top layer (which should be salt) and place a heavy weight in a bowl on the plate. After about 12 hours there should be enough brine formed to cover the beans. If some of the beans are still uncovered, top up the crock with a brine made in the proportion of 1 lb of salt to 2 quarts of water. More beans may be added to a partly filled jar from time to time. Cover the filled jar with a lid to keep out dust.

To use, wash the beans thoroughly in running water or soak them for a few hours, changing the water several times. Cook the beans quickly in unsalted boiling water.

Canned or Bottled Beans

Butter, french, or runner beans may be used.

Wash and string the beans. They may be either sliced or left whole, depending on their size.

Blanch the beans before packing them into jars or cans. Place a rack on the bottom of a large saucepan and pour in boiling water until it just touches the bottom of the rack. Lower the prepared vegetables in a wire basket or tied in butter muslin on to the rack and cover the saucepan tightly. For blanching leave three minutes in the steam (count the time from when the steam begins to escape from the lid of the saucepan) and then remove the beans and dip them into ice cold water. Drain them and pack them in the jars or cans, and cover with a brine made in the proportion of a teaspoon of preserving salt to 1 quart of water. A little sugar may be added to help preserve the fresh green colour. Seal or close the jars or cans according to the kind used.

Process in a water bath for three hours or a pressure cooker at 10 lb pressure for 25 minutes. Remove the jars or cans from the hot water and complete seals where necessary. Label with name of contents and the date. When using, boil the beans for 15 minutes before eating them to avoid any risk of food poisoning.

Frozen Beans

Home frozen beans are prepared and blanched in the same way as for bottling or canning. Do small quantities of 4 or 5 lb at a time so that there is as little delay as possible between slicing the beans and placing them sealed in packages in the freezer. This ensures good colour, flavour, and texture. The blanching time for freezing is 1¾ minutes. Chill, drain, and pack the beans into labelled packages. Seal the packages, excluding as much air as possible, and pack them into the freezer.

Frozen beans need not be thawed before use; simply plunge them into boiling salted water, breaking up the blocks with a fork. Cook for five minutes or until tender. There is no danger of food poisoning when this method is used.

—*BETTY JOHNSTON, Home Science Instructor,*
Department of Agriculture, Wellington

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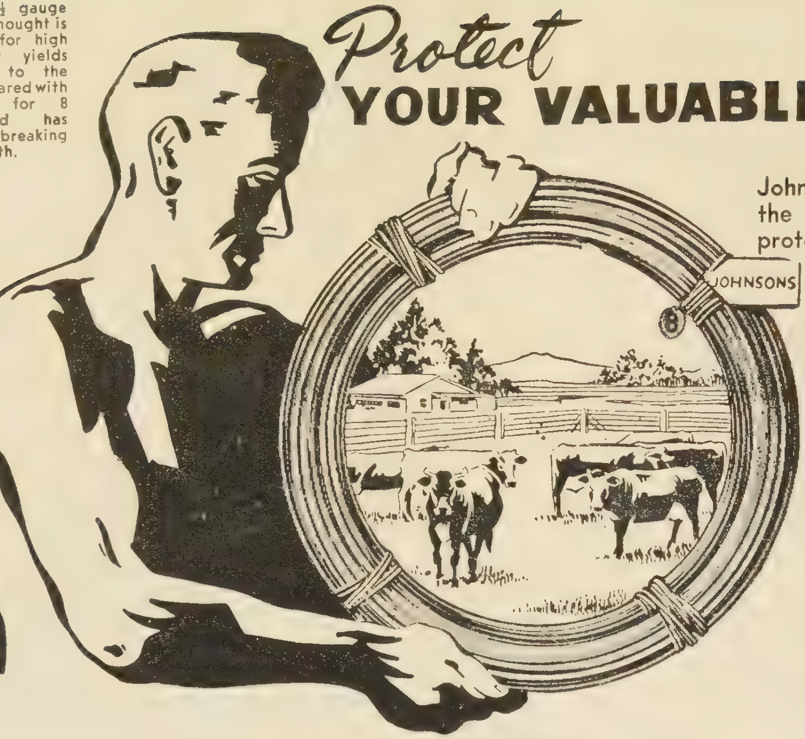

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Because of continuing demand and a shortage of other published material about training of sheep dogs, the Department of Agriculture has reissued Bulletin No. 308, "Rearing and Training a Sheep Dog".

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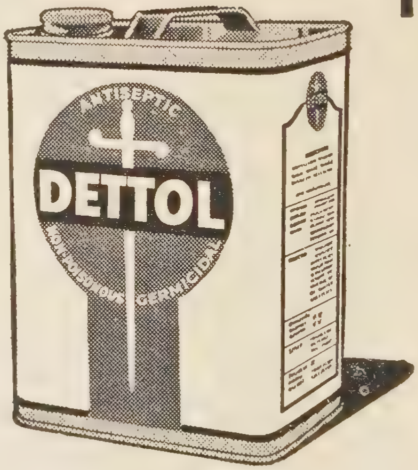

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[*Green and Hahn* [*Sparrow*

Dwarf beans can be grown closer in the home garden than in market gardens, where mechanical tools are used. The beans at left are beginning to yield and the heavy crop at right is ready for picking.

used exclusively for this purpose today.

Blue Lake is a white-seeded bean with round, straight, blunt-ended pods. Though it is resistant to some strains of rust, tests carried out at Plant Diseases Division, Department of Scientific and Industrial Research, have shown that it is susceptible to the strains of rust in New Zealand. Quite severe outbreaks of rust have occurred on Blue Lake in the Motueka district.

Tendergreen and Topcrop varieties of dwarf french beans appear to be as resistant as Westralia to rust in New Zealand.

Runner Beans

Runner beans form a perennial rootstock and may be grown under a permanent bean fence, though it seems advisable to renew the plants by saving seed every three or four years. Runner beans are grown for market on a limited scale, particularly in southern areas.

Scarlet Runner Varieties

Scarlet runner varieties include Scarlet Runner Emperor, a large heavy cropping tall plant with brilliant scarlet flowers and very long tender pods; Mammoth Scarlet with very large and long pods which remain stringless for a long time; Prizewinner, a very fine variety with very long pods. Some very fine strains of scarlet runner beans are now available, though the names of some of the varieties listed by seedsmen are synonyms.

Broad Bean Varieties

Broad bean varieties include Spanish types such as Aquadulce, a very fine variety with large pods, Seville Longpod, and Seville Longpod (Improved), which are early, reliable, heavy bearing varieties with medium length pods. These are proving popular for process growing.

The well known English early varieties are Early Longpod, Exhibition Longpod, Leviathan Longpod, and Mammoth Longpod and the English Windsor variety with large broad pods. Also there are early dwarf, much branched, heavy cropping varieties such as Coles Early Dwarf and The Sutton. These are particularly useful in windy areas.

Government Approved Bean Seed

Two lines of selected pole bean seed produced by Crop Research Division, Department of Scientific and Industrial Research, Shiny Fardenlosa and Westralia are being multiplied under the Government Approved Vegetable Seeds Scheme. The stock seed is multiplied by members of the Horticultural Seedsmen's Association and the crops are inspected by Horticulture Division officers.

Sowing

It is advisable in most districts to make more than one sowing of french beans to ensure continuity of supply, but most varieties of runner beans will bear until cut down by frost if pods are picked regularly before they are fully mature. Dwarf beans develop pods earlier, taking about seven to nine weeks compared with nine to 10 weeks for most climbing varieties.

Half to 1½ bushels of seed according to seed size and planting distances is required to sow an acre of beans. Bean seed is usually sown in drills 1½ to 3 in. deep.

Dwarf beans are usually sown about six to eight seeds to the foot, with the rows 24 to 30 in. apart, though rows may be in pairs 18 to 20 in. apart between the close rows and 30 to 40 in. apart between each double row to allow more room for picking.

Runner beans are sown about four to eight seeds a foot of row if a fence trellis support is given with trellises spaced 5 ft apart between rows. Usually three to six seeds are sown to a foot of row if the tripod stake method of support is used. The rows are usually 30 in. and 42 in. apart alternately if supported by the tripod stake method.

Soil and Manure

Beans need a fertile, well drained soil, well supplied with moisture, free from weeds, and worked to a good tilth. Fertilisers or organic manure should be well worked into the root area some time before sowing, though where only artificial fertilisers are used a band may be placed under the seed or even over the seed. It must not come in contact with the seed.

In most soils the usual fertiliser application for beans is richest in phosphate and with only a moderate amount of nitrogen, but fertiliser dressings vary considerably according

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citrus
berry fruits
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vegetables
flower crops
nursery plants

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Rogor 40 may also be obtained from your local branch of The New Zealand Fruitgrowers' Federation and from J. H. Barbour and Son Ltd., 66 Vivian Street, Wellington.

FISONS PEST CONTROL

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to soils and local practice. Some growers work in heavy dressings of fowl manure which they may or may not supplement with superphosphate. Blood and bone at up to a ton to the acre is applied by others. In fertile soils 2 to 4 cwt to the acre of superphosphate may be used alone or 2 to 4 cwt to the acre or more of a fertiliser with nitrogen-phosphate-potash ratio of 2 : 2 : 1 or 1 : 4 : ½ may be used. In Pukekohe 6 to 12 cwt of serpentine superphosphate and sulphate of potash mixed in a weight ratio of 4 : 1 usually gives good results. In the Auckland district a mixture of 5 cwt of blood and bone, 5 cwt of superphosphate, and ½ cwt of sulphate of potash is recommended as a side dressing only.

Heavy applications of lime are necessary in some districts and generally lime should be applied to most soils where beans are being grown.

Beans are legumes. The nodule bacteria on their roots fix atmospheric nitrogen as do clover, peas, and other leguminous plants. Some instances of poor cropping have been associated with poor nodule development or even lack of nodule development. Even in fair crops some patches can be found where nodulation is poor.

Cultures of nodule bacteria suited to bean growing are now available commercially, and though early trials with adding nodule bacteria for bean growing in New Zealand did not show much result, the newer strains may have more promise. Nodule bacteria by themselves, however, are not likely to make up for poor growing conditions in other respects.

Some interesting results on the effect of rates of nitrogenous fertiliser on bean yields may come from a series of trials now being run at the Levin Horticultural Research Station.

Support for Pole or Runner Beans

Pole or runner beans are sometimes grown in rows as are dwarf beans, but the tops are slashed when the plants are well established to make the plants branch and become bushy; however, better crops are obtained if the plants are given support, the two principal ways of which are by trellis and by tripod.

In the trellised fence method the main posts of the fence are usually about 6 ft high. The two posts at each end of the row are set 25 to 30 ft apart and props are used between to support the trellising, as the remaining posts are 50 to 60 ft apart. Number 12 wire is stretched along the tops of the posts and at each end run from the top of the second post to the bottom of the end post to serve as a brace. A strand of wire is then run from the top of the second post to the top of the end post. Binder twine is then run along the line of posts about 6 in. from the ground, secured, and pegged at intervals to prevent it from being pulled too high when it is being strung with twine.

[Green and Hahn

Runner beans supported on stakes. Seedling dwarf beans are growing in the foreground.

Stringing is done by passing the ball of twine up and down over the top wire and under the twine along the bottom, the ball of twine being held securely on a stick to facilitate handling, and stringing proceeds along the fence until the twine is finished. No cutting is necessary. The apexes formed by the string as it is looped over and tightened are about 16 in. apart. Trellises are spaced about 5 ft apart between the rows.

Sections between widely spaced posts require propping and props are used with a V cut in the top to support the wire and a flat piece of board is nailed on the bottom of the prop to prevent its being thrust into the ground under the weight of the plants. Twine is preferred to wire along the bottoms of the posts, as it is easier to clean up at the end of the season.

In the Hastings district much lighter twine is now used and some developments in mechanical staking and stringing are being adapted to local conditions.

In the tripod method of support 6 or 7 ft stakes are thrust into the ground about 12 in. apart along the rows as soon as the plants are up. Cultivation is continued between the rows until the plants are 2 to 3 ft up the stakes, when a last cultivation is given between the narrow rows before the stakes are gathered together at the tops, three from each row, and tied together over the 30 in. space to form a self-supporting tripod of six stakes.

Some Pests and Diseases of Beans*

Seedling Disease

Pre-emergence damping off and seedling wilt occur on seedlings sometimes before emergence and are caused mainly by the common soil fungus *Pythium ultimum* Trow., which is responsible for seedling damping off of many plants. The disease can be controlled by dusting the seed with thiram or suitable proprietary seed dusts.

Halo Blight

Halo blight is a bacterial disease which attacks dwarf and annual and perennial runner beans. The first obvious symptoms appear on the twin leaves as dark green, shining angular spots about 1/16 in. in diameter on both leaf surfaces. On older, rapidly growing plants symptoms on leaves are more conspicuous. The spots are similar in appearance, but are usually surrounded by circular, bright yellow haloes ¼ to ¾ in. in diameter. Haloes are most conspicuous when only a few spots are on each leaf. Infections near the margins cause distortion of leaves.

On pods small, water-soaked, circular spots 1/16 to ⅛ in. in diameter increase in size to about ⅜ in. and become dark green. In moist weather, bacterial ooze exuded from the spots gives them a slimy appearance. Later this bacterial slime dries and forms a grey film over the surface. In

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* Acknowledgment: Department of Scientific and Industrial Research Bulletin 114 "Diseases and Pests of Peas and Beans in New Zealand and their Control".

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mature pods these lesions become dark brown and though not sunken as in anthracnose, they can be confused with those caused by anthracnose. The yellow haloes do not occur on pods.

Bean varieties vary greatly in their susceptibility to halo blight, and generally white-seeded varieties and runner beans are the most resistant.

Halo blight is best prevented by the use of disease-free seed and rotation of crops. If infection does occur, it can be controlled by spraying with copper oxychloride. Crop rotation should be practised and successive plantings isolated as much as possible; in market and domestic gardens satisfactory control can be secured by growing resistant varieties.

Anthracnose

Runner beans are relatively resistant to the fungous disease anthracnose (*Colletotrichum lindemuthianum*), but in early and late crops of dwarf beans severe infection of the pods or sometimes even total loss of the crop may occur. Infection occurs on leaves as small, dark brown, angular dead areas on the upper surfaces and as dark brown to black lesions along the undersides and on stalks. On pods small, dark brown spots about 1/16 in. in diameter gradually enlarge to about ½ in., the centres become lighter in colour with slightly raised dark brown or black margins. Pinkish or lighter coloured spore masses form on the surface of spots. When dry these appear as grey, brown, or black pimples. On seed the disease shows as small dark brown almost circular sunken spots from 1/16 in. to about ¼ in. in diameter.

Anthracnose is spread mainly by infected seed. It can also survive in the soil on decaying matter for about two years. The disease spreads from plant to plant by spores and rapid spread is favoured by wet weather and temperatures of 60 to 70 deg. F.

Control measures include the use of clean seed, long rotations between bean crops, and copper oxychloride or bordeaux sprays at fortnightly intervals beginning when the plants are in the second leaf stage, or the use of resistant varieties.

Dry Root Rot

Dry root rot is caused by infection of roots with *Fusarium solani*. Reddish discolouration of the tap root gradually extends until the tap root is covered; streaks may extend almost to soil level.

The fungus can remain alive indefinitely in the soil on decaying matter, and crop rotation should be practised to reduce infection. Seed should be dusted before sowing with thiram or other suitable protective seed dust, and infected refuse should be burnt after harvesting and not worked into the ground.

Grey Mould

Grey mould or botrytis rot (*Botrytis cinerea*) of beans is a common wound parasite occurring on many different host plants. Water-soaked, greenish brown areas develop rapidly on stems and leaves, causing wilt and death of plants. Greyish brown mould growth and spore masses are the most characteristic symptoms of the disease.

Plants should be well spaced and given good aeration. Infected material should be collected and burnt. Where the disease is troublesome, plants should be sprayed during the growing season with thiram at intervals of two or three weeks.

Bean Rust

Bean rust fungus (*Uromyces appendiculatus*) attacks leaves, pods, and occasionally tender parts of stems of dwarf and runner beans. On leaves it first appears as minute, light-coloured, slightly raised spots or pustules which may reach a diameter of 1/16 to 1/12 in. After a few days they rupture and expose light brown, rust coloured spore masses. In heavy infection a ring of secondary pustules often develops outside the ordinary pustules. Leaves may shrivel and fall from the plant.

Bean rust is spread by wind-blown spores which are carried over long distances. Overwintering spores carry over the fungus from year to year on dead leaves and other bean refuse that has not been destroyed or worked into the ground. Two varieties, Westralia and Fullgreen, are resistant.

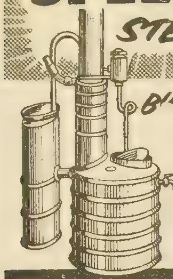
Control consists of the destruction of all bean refuse from an infected crop and the disinfection of stakes by immersion in an 8 per cent copper sulphate solution or lime sulphur 1 : 10. In the field infected plants should be sprayed with lime sulphur half gallon and colloidal sulphur 70 per cent 1 lb to 100 gallons or zineb 65 per cent 2 lb to 100 gallons at intervals of two to three weeks.

Sclerotinia Disease

Sclerotinia disease (*Sclerotinia sclerotiorum*) causes irregular, water-soaked areas on stems followed later by similar spots on branches and leaves. These lesions rapidly enlarge, causing a soft, watery rot on infected tissues. During mild, humid conditions after infection a white cottony growth of the fungus appears in which

[*Sparrow*

Good strains of broad beans yield heavily in favourable situations.



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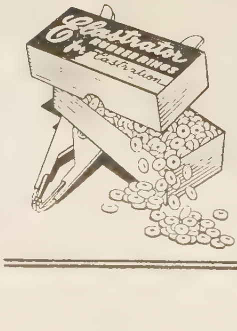


are formed small irregular shaped, black bodies about ¼ to ⅜ in. long.

Plants should be well spaced and humidity kept low. The ground between the plants should be well worked. All diseased plants should be removed immediately they are observed and care taken that sclerotia do not fall to the ground. Infected plants should be burnt.

Bean Mosaic

Bean mosaic is a virus disease which occurs on dwarf and runner beans. On dwarf beans symptoms vary with the variety, age of plant, and environment. On the first leaves to show symptoms the veins sometimes turn dark green, while the remainder of the leaf becomes light green or yellow. Leaves formed after infection may show a general diffused mottling or a well defined mosaic pattern in which the darker green areas make greater growth, producing a crinkly appearance like the leaves of a savoy cabbage; or they may become paler, more pointed, and slightly narrower than normal and show extensive dark green areas associated with the veins.

Sometimes leaves are misshapen and show a downward rolling at the edges and tips, but often there is little distortion. Infected plants are pale and slightly stunted; they set fewer pods than do healthy plants.

On infected runner beans leaves are slightly curled and distorted, with a pronounced mosaic mottling in which the dark green areas are raised, giving the appearance of blisters. Infected plants are stunted, spindly, and the number of leaves reduced. The few pods formed are small and contain fewer seeds than those of healthy plants.

The disease is spread in the field by aphids. The virus is seed carried and this is the main method by which it carries over from one season to the next, but it can also overwinter on perennial runner beans.

Rust of Broad Beans

Rust of broad beans (*Uromyces fabae*) is a fungous disease and symptoms usually appear first on plants after flowering as small, whitish pustules or spots up to ⅛ in. in diameter on leaves, leaf petioles, and stems. Frequently the spots are surrounded by light yellow haloes. The pustules soon burst and produce masses of cinnamon-brown spores which can be readily brushed off leaves and stems.

When infection is severe leaves are almost completely covered with spore masses. In such instances partial defoliation and stunting of the plant occurs, with resultant reduction in crops. Death due to infection is rare. Broad bean rust is carried over from season to season as spores either on diseased bean refuse from previous crops or on infected volunteer plants.

Control consists of the removal and burning of diseased material after harvesting. The severity of the disease can be reduced in the field by spraying plants at 14- to 21-day intervals with zineb.

Chocolate Spot

Chocolate spot (*Botrytis cinerea*) is sometimes troublesome on crops subject to severe climatic conditions during winter. It is more common on winter-sown beans than on those sown in spring. Small, chocolate coloured spots or blotches of variable shape appear on leaves, leaf stalks, and stems, and may coalesce; partial defoliation may occur and some plants may be killed.

The disease is carried over from one season to the next on infected plant debris, and damage is greatest during prolonged periods of high humidity, but soils deficient in potash, close spacing, and poor drainage are predisposing factors.

Control consists of rotation and burning of bean refuse, and in areas where the disease is troublesome plants should be sprayed every two or three weeks during winter with thiram. Spacing and drainage are very important, particularly in heavy soils.

Some Important Insect Pests of Beans

Caterpillars

Caterpillars can be controlled by spraying at 10- to 14-day intervals with DDT, though to avoid poisonous residues sprays should not be applied when pods are maturing. For sprays closer to harvest HETP, TEPP, or sevin can be applied.

Aphids

The black bean aphid (*Aphis craccivora*, Koch.) is sometimes troublesome on beans, but can readily be controlled by spraying with nicotine sulphate plus soft soap or with lindane.

Green Vegetable Bug

The green vegetable bug (*Nezara viridula* L.) attacks beans in the North Island and in the Blenheim and Nelson districts. The adult is green, shield shaped, about ½ in. long by ⅜ in. wide, and flattened. About one-third of the distance along the back from the head there is a transverse groove, and in the mid portion of this there are three small white spots. These distinguish it from a native shield bug which is much the same size, shape, and colour but is not a pest.

Methods of control include the following (the most appropriate to the local situation can be used):

DDT 50 per cent wettable powder, 1 lb to 100 gallons of water (½ oz to 4 gallons). This is slow acting and may take several days to kill. Its effect lasts for 10 to 14 days, but beans should not be sprayed within three weeks of harvesting because of the risk of poisonous residues.

Malathion emulsion, 1 pint to 100 gallons (4 teaspoons in 4 gallons). This is slow acting. The residual effect lasts for a few days. It does not cause plant injury. Beans should not be sprayed within 14 days of harvesting, as spraying may taint the beans for 21 days or more.

HETP, 1 pint to 100 gallons (4 teaspoons in 4 gallons), or TEPP, ½ pint to 100 gallons (2 teaspoons in 4 gallons), are quick acting and the residual effect lasts only about a day.

Sevin, a new insecticide, shows some promise for control of green vegetable bug.

Collembola or Springtails

Bean seedlings are occasionally attacked by collembola or springtails which are white, elongated (1/25 to 1/16 in. long) insects which move to some extent by springing. They usually damage the emerging seed shoot or the seed leaves so that the seed or seedlings die. They can be controlled by soaking the ground round the germinating seedlings with nicotine sulphate plus soap.

Red Spider Mites

Red spider mites (*Tetranychus urticae* Koch.) web the undersurfaces of the leaves of beans, denuding them of their green colouring matter and reducing their function and consequently the crop. The mites are about 1/50 in. long, red in autumn and the overwintering stage, but during the growing season they are yellow, green, brown, or red. They can be controlled by spraying with HETP or TEPP or with malathion.

Cutworms

Cutworms, which may be caterpillars of a number of different moths, occasionally eat through the stems of seedling beans at ground level. They can be controlled by spraying with DDT 50 per cent, 1 lb, plus lindane 50 per cent, 1 lb per acre, as soon as the seedlings emerge.

Stem Boring Maggots

Small, stem boring maggots (*Hylemyia* sp.) can be controlled by spraying DDT at ground level.

Weevils

The adult bean weevil (*Bruchus obtectus* Say.) is about ⅛ in. long, grey, with wing cases which do not cover the whole of the back but leave the apical portion of the reddish brown abdomen exposed. The female lays eggs in holes or crevices on the pods and these usually hatch and the larvae enter the seed before the beans are harvested. In store they develop into adults, which cut their way through the seed coat and emerge by round holes about 1/16 in. in diameter.

Severely damaged seeds fail to germinate.

Control consists of threshing the beans as soon as possible after harvesting and treating the seed with a dust containing DDT or lindane. Untreated infested seed should not be sown, as germination will be poor and the weevil will be introduced into the field to infest the resulting crop.

January Work in the Home Garden

EXCEPT in mild northern districts where the work can be deferred for another month, set out early and late maturing varieties of savoy or winter cabbage, winter cauliflower or broccoli (several varieties each of a different maturity period to ensure succession), borecole or kale, brussels sprouts, leeks, round or summer cabbage, and cauliflower varieties maturing in three, four, or five months for succession.

MULCH plants in hot, dry soils with materials such as lawn clippings, partly rotted straw or leaves, or sawdust. Sawdust is useful too for suppressing weeds if it is applied 3 or 4 in. thick, but too much should not be dug into the ground if it is unrotted or it will check the growth of plants. In dry weather the hose may have to be used, but light sprinklings should be avoided, as they tend to encourage surface rooting. A moist soil is especially important for celery, beans, and lettuce.

Sow a cover crop on any ground not to be used for cropping for some time.

Lift kumara runners to prevent them from rooting.

Remove side shoots of tomatoes and also give support to tall and intermediate varieties.

Keep the hoe sharp and hoe out weeds when they are small. Hoeing is most effective in warm, dry weather.

Build a tidy compost heap with unwanted vegetable refuse. Burn only woody material or material affected with readily spread pests and diseases.

Keep potatoes earthed up to prevent greening of the tubers and to protect them against infestation with potato tuber moth.

Successional Sowings

Dwarf beans, beetroot, carrots, kohl rabi, lettuce, mustard and cress, peas, radishes, silver and perpetual spinach beet, spring onions, tampala, turnips.

Other Sowings if Not Yet Done

Parsnips (now late for sowing, except in districts having a long, mild autumn) and swede turnip.

Spraying

Spray tomatoes and vegetables infested with caterpillars, vegetable weevils, green vegetable bugs, and other active pests with DDT or with lindane and DDT mixed if aphids (grey aphids and green fly) are also present.

Spray potatoes and tomatoes with copper sprays (bordeaux or copper oxychloride) or certified substitute where conditions tend to be warm and humid and potato blight is present or likely to be troublesome.

Spray beans and other crops infested with red spider mite with summer oil and nicotine sulphate or with a certified miticide (the mites are tiny, greenish, yellowish, or reddish, and feed on the undersides of the leaves, denuding them of their green colouring matter).

Spray onions and other crops infested with thrips with DDT or lindane.

Spray celery where necessary against leaf diseases with captan or zineb or copper sprays.

Under Glass

Give tomato houses full ventilation. Where necessary spray tomatoes affected with leaf mould fungus at 10-day intervals with salicylanilide or zineb. Thiram is particularly effective against the common form of stem rot (*Botrytis*). Heavy applications of captan or maneb usually give protection against the less common form of stem rot (*Didymella*).

See Your Farm Dairy Instructor before Buying a Dairy Water Heater

THE satisfactory cleaning of milking machines and equipment installed in milking sheds depends largely on the efficiency of the water heating appliance used.

Electric hot water cylinders are generally accepted as being the most convenient, efficient, and economical means of providing boiling water at milking sheds, but they must be of the right size, have the correct element and thermostat setting, and be constructed to operate economically.

Unfortunately at many dairies the electric hot water cylinder is inefficient for a number of reasons:

1. It is too small for the size of milking machine.
2. The element is too small to heat the required quantity of water.
3. The cylinder is corroded and the lagging too damp for effective insulation.
4. The design is unsatisfactory and not economical to operate.

Installations of dairy-type water heaters are governed by regulations which have been framed to meet the requirements of the dairy industry and to conserve electric power. The only cylinders which can be legally installed are those which have been tested for efficiency and are approved by the Dairy Division of the Department of Agriculture.

Dairy farmers wishing to replace cylinders or to install new ones should seek the advice of their local Farm Dairy Instructor before making any arrangements to buy heaters.

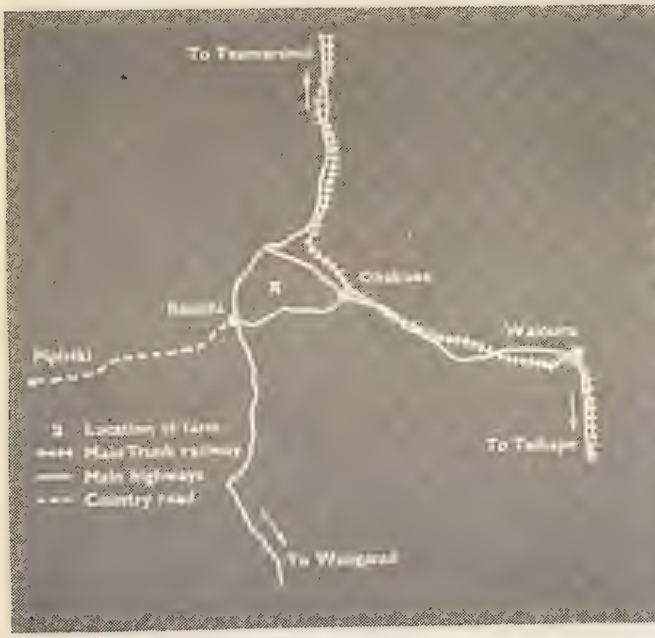
STUDIES IN FARM MANAGEMENT

From A Mass of Logs and Stumps

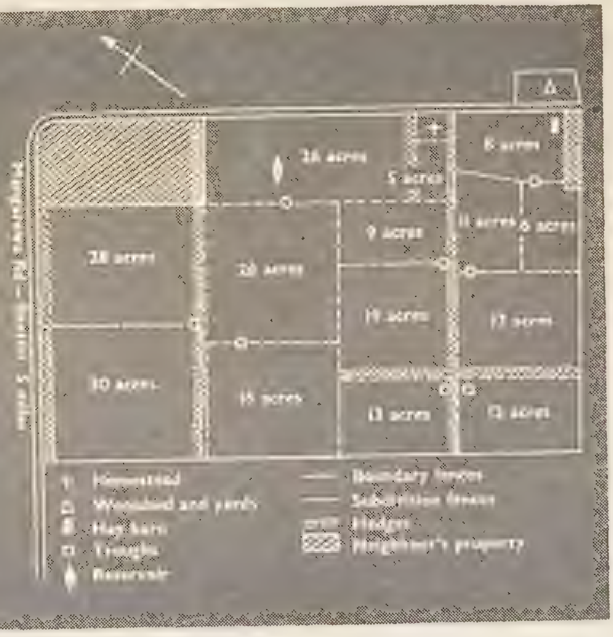
A Waimarino Fat Lamb Farm

By A. A. DUNCAN,
Farm Advisory Officer,
Department of Agriculture,
Wanganui

STUMPS and logs after unsuccessful bush burns have been characteristic of the landscape of Waimarino County. Several market garden crops have frequently pioneered the way for grassing large areas of what is now predominantly a sheep farming area. Development and management of a fat lamb farm on this previously heavily bushed country near Raetihi are described in this article.


To Taumarunui
Ohakune
Raetihi
Pipiriki
Waiouru
To Taihape
To Wanganui
Location of farm
Main Trunk railway
Main highways
Country road

LOCATION OF FARM


26 acres
5 acres
6 acres
9 acres
11 acres
6 acres
28 acres
20 acres
19 acres
17 acres
30 acres
15 acres
13 acres
12 acres
Homestead
Woolshed and yards
Hay barn
Troughs
Reservoir
Boundary fences
Subdivision fences
Hedges
Neighbour's property

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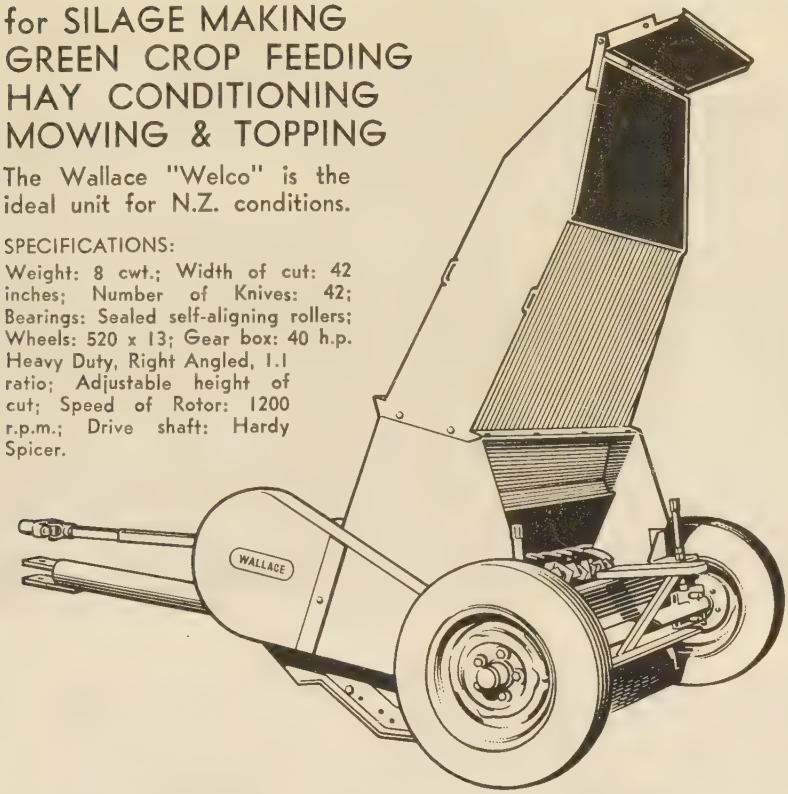

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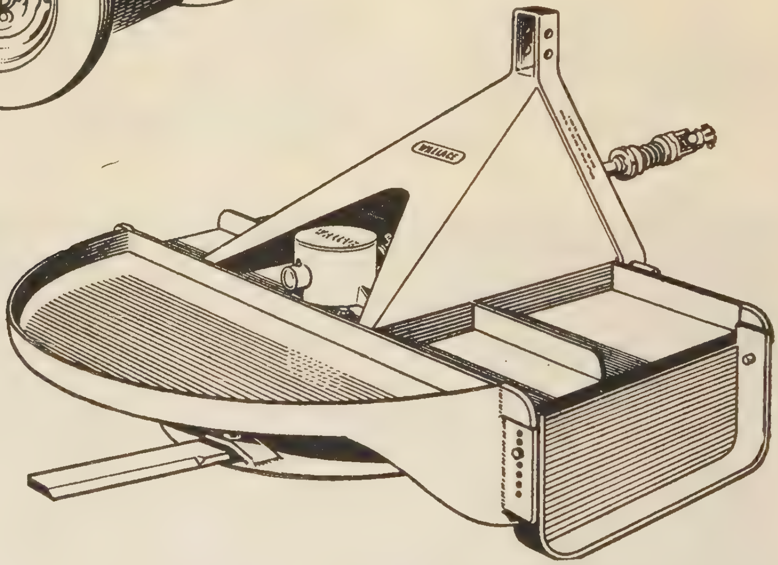

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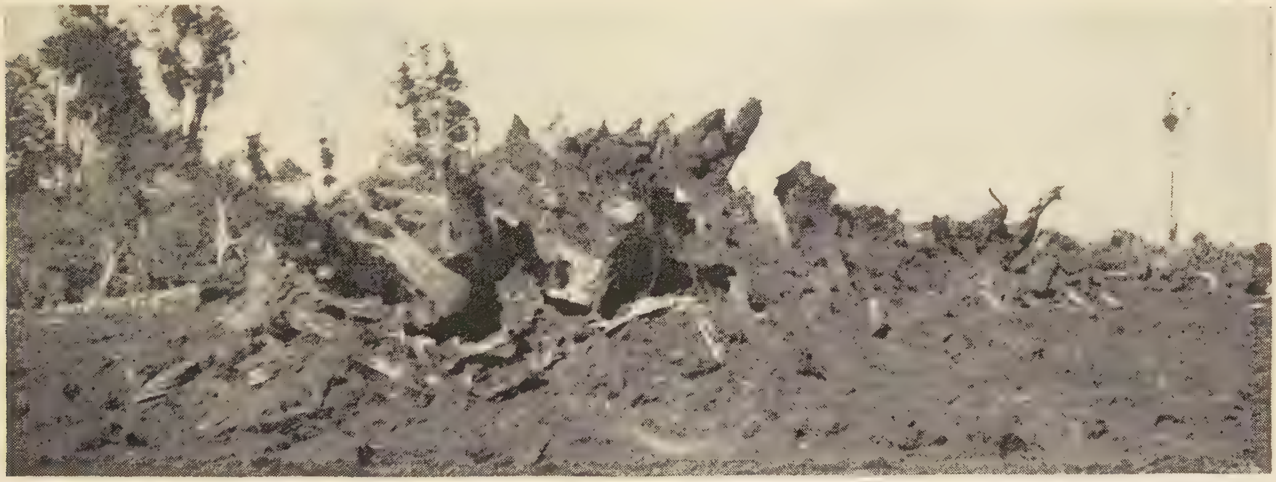
WAIMARINO FAT LAMB FARM

WAIMARINO County is situated on the Western Uplands of the North Island and extends from the Wanganui River in the west across Mt Ruapehu in the north to Waiouru in the east. The type of country varies from the steep mudstone and sandstone hills near the Wanganui River to the flat and rolling plateaus of Raetihi-Ohakune.

Sheep farming is predominant in the county, but dairying and market gardening are also fairly well represented. Vegetables produced in the district are reputed to have a flavour all their own and the expression "There is no carrot like a Waimarino carrot" is widely known in the North Island.

Market gardening has played a large part in the development of the fat lamb farms in the district. The country was a mass of stumps and logs after the rather unsuccessful bush burns and it was a common practice for Chinese to lease a block of this type of land and develop it for market gardening. They cleared the logs and stumps into windrows with bulldozers and then took two or three market

The country was originally in native bush consisting mainly of rimu, matai, kahikatea, and maire.



▲ Masses of stumps and logs remained after bush burns and were bulldozed into windrows 5 chains apart.

▼ Two or three market garden crops were taken from the land. The crop being harvested is potatoes.

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Mr and Mrs Ritchfield.

The homestead, the placement of which can be seen in the plan of the farm layout on page 593. Excellent shelter is provided by hedges of Lawson's cypress.

garden crops before the lease expired and the farmer grassed the land down. The county area and stock numbers are (1957 figures):

Occupied area (acres) ..	375,615
Area in sown grass (acres)	182,733
Breeding ewes	207,538
Total sheep	400,445
Beef cattle	33,776
Dairy cattle	4,434

Climate

The annual rainfall of 65 to 70 in. is well spread throughout the year and there is very seldom a summer drought. Growing conditions for pastures are generally very good in late spring, summer, and early autumn.

The county has an average elevation of 2,200 ft and is about 60 miles inland. The winters are long and cold and there are occasional snow falls. The cold winters make supplementary winter feeding an important aspect of farm management. Frosts occur from the beginning of June to the end of September; an occasional early frost in May or a late frost up to the middle of November is possible. In 1958, which was an average season, the Raetihi meteorological station recorded 69 frosts, the heaviest being 19 degrees.

The average monthly rainfall over the period 1953-58 has been:

	in.		in.
January ..	2.59	July ..	6.82
February ..	4.37	August ..	6.04
March ..	4.05	September	2.38
April ..	5.31	October ..	6.24
May ..	9.36	November ..	7.05
June ..	6.72	December ..	7.30

Rain falls on an average of 177 days in the year.

Soil Types

The ash deposited from the Mt Tongariro eruption is the basis of the soils in the Raetihi-Ohakune district. The soil is a reddish-brown loam and is recorded in the 65 series on the soil maps accompanying Soil Bureau Bulletin (n.s.) 5. The topsoil, about 8 in. deep and overlying a coarse, sandy, brown subsoil, is very much more fertile than the subsoil and this makes relatively shallow ploughing a prerequisite of good farm management.

The Tongariro ash shower is characterised by brown ash fragments smaller than a pinhead. Hard boulders that are interspersed with the soil in some parts of the district were deposited from mud flows which poured out during volcanic eruptions. The Tongariro ash shower is composed of andesitic material and contains more iron, lime, and magnesia than the pumice soils of the Taupo area. Soils derived from andesitic ash are reddish; their texture is much finer and they hold moisture much better than the pumice soils.

The original cover was podocarp broadleaf forest, much rimu, matai, kahikatea, and maire, stumps and logs of which can still be seen on some of the less developed land in the district.

The soils are deficient in phosphate and tend to go back into bracken fern if the fertility is not maintained by the use of phosphatic fertilisers. Potash bearing minerals are also rather deficient and potash tends to become short as the phosphate level is built up. Most of the intensively farmed holdings in the district are now using potash.

The flat and rolling volcanic ash soils of Raetihi-Ohakune are becoming increasingly important for fat lamb production, and the management of a fat lamb farm on this country is described in this article.

A FAT LAMB FARM

The property farmed by Mr K. J. Ritchfield is situated on the Mangarewa road five miles from Raetihi and 62 miles from Wanganui. The farm is of 229 acres, all ploughable. It is 2,200 ft above sea level. Mr Ritchfield took over the farm in 1949 under the rehabilitation scheme for ex-servicemen and in that year it wintered 600 ewes. The winter carrying capacity has subsequently been increased to 900 ewes.

Flock Management

The flock consists of 900 mixed-age Romney ewes. About 180 two-tooths are bought in at the Raetihi or Taihape ewe fair in February each year. They are kept for five years and sold as cast-for-age six-year-old ewes at the same fairs. The bought-in two-tooths are vaccinated for pulpy kidney in March and the whole flock is vaccinated in early August for both blackleg and pulpy kidney.

All the ewes are foot rotted and checked for malformed or diseased udders in February and the rams (Southdown) are put out in the last week of March at three per 100 ewes.

All the older ewes are run in one mob for tupping, but the two-tooths are kept separate and tupped with four-tooth rams. After tupping both the two-tooths and the older ewes are run together. The ewes are crutched in June and the rams taken out, and any lame ewes are foot rotted at the same time.

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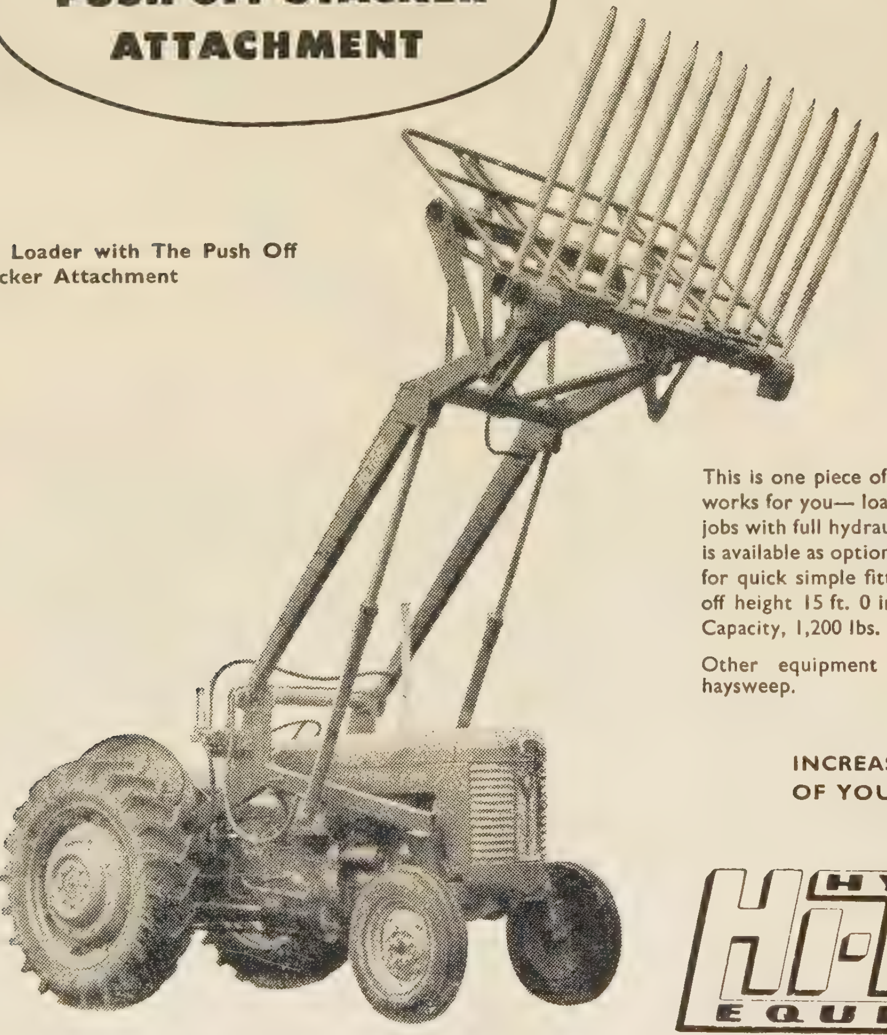

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Lambing starts the third week in August and a lot of time is spent with the flock over the lambing period. The flock is shifted each day and this results in the lambed ewes staying behind in the paddock while the unlambed ewes move readily through the gate.

The ewes and lambs are moved when the lambs are two or three days old and put into paddocks at five ewes to the acre. They stay in these paddocks until the first draft of lambs is taken in January. Regular shifting of the unlambed ewes during lambing results in all the late lambers and dry ewes being together in one paddock.

The lambs are docked in their paddocks when three weeks old and are vaccinated against scabby mouth at the same time.

The ewes are shorn in early November, which is fairly early for the district. Sheep are liable to become cast on this farm and they are shorn early to reduce this problem as much as possible. The ewes from each paddock are shorn separately so that mobs are relatively small and there is very little mismothering of lambs.

The first draft of lambs, fat off the mothers, is taken in the middle of January, when about 600 lambs (60 per cent) are sent to the freezing works at an average weight of 34 lb. The remaining lambs are weaned, drenched with phenothiazine, dipped, and grazed lightly over several paddocks. At this time the ewes are all run together again and done moderately hard.

The second draft of lambs is taken at the end of February, six weeks after the first, a further 200 being sent away. About 200 lambs are left and most of these are drafted fat in April. The 20 or 30 that remain are either sold fat later or killed for home use.

▲ Valuable shelter for stock is provided by this eight-year-old Lawson's cypress hedge.

▼ Shorn ewes with lambs. The photograph was taken in November.

Lambing Percentages

Lambing over a ten-year period has averaged 113 per cent of ewes put to the ram.

The death rate in ewes is 3 per cent. Lambing since 1949 has been as follows:

	Ewes to the ram	Lambs	Lambing percentage
1949 ..	598	652	109
1950 ..	622	728	117
1951 ..	622	725	117
1952 ..	674	804	119
1953 ..	720	795	110
1954 ..	800	932	117
1955 ..	859	930	108
1956 ..	850	906	107
1957 ..	900	1,005	112
1958 ..	900	1,036	115
1959 ..	900	1,063	118

Bought in Lambs

The growth of feed is fairly prolific in January and after the first draft of lambs in mid January 200 Romney wether lambs are bought in for fattening. These are kept separate from the home lambs and are sent off fat in April.

Wool Weights

The ewes clip about 10 lb of wool of a 46/50 count, wool weights for the past four seasons being as follows:

	Ewes	Fleece weight lb	Crutchings	Total lb
1956 ..	850	7,090	978	8,068
1957 ..	900	7,982	1,340	9,322
1958 ..	900	8,909	1,699	10,608
1959 ..	900	7,963	1,410	9,373

Cattle Management

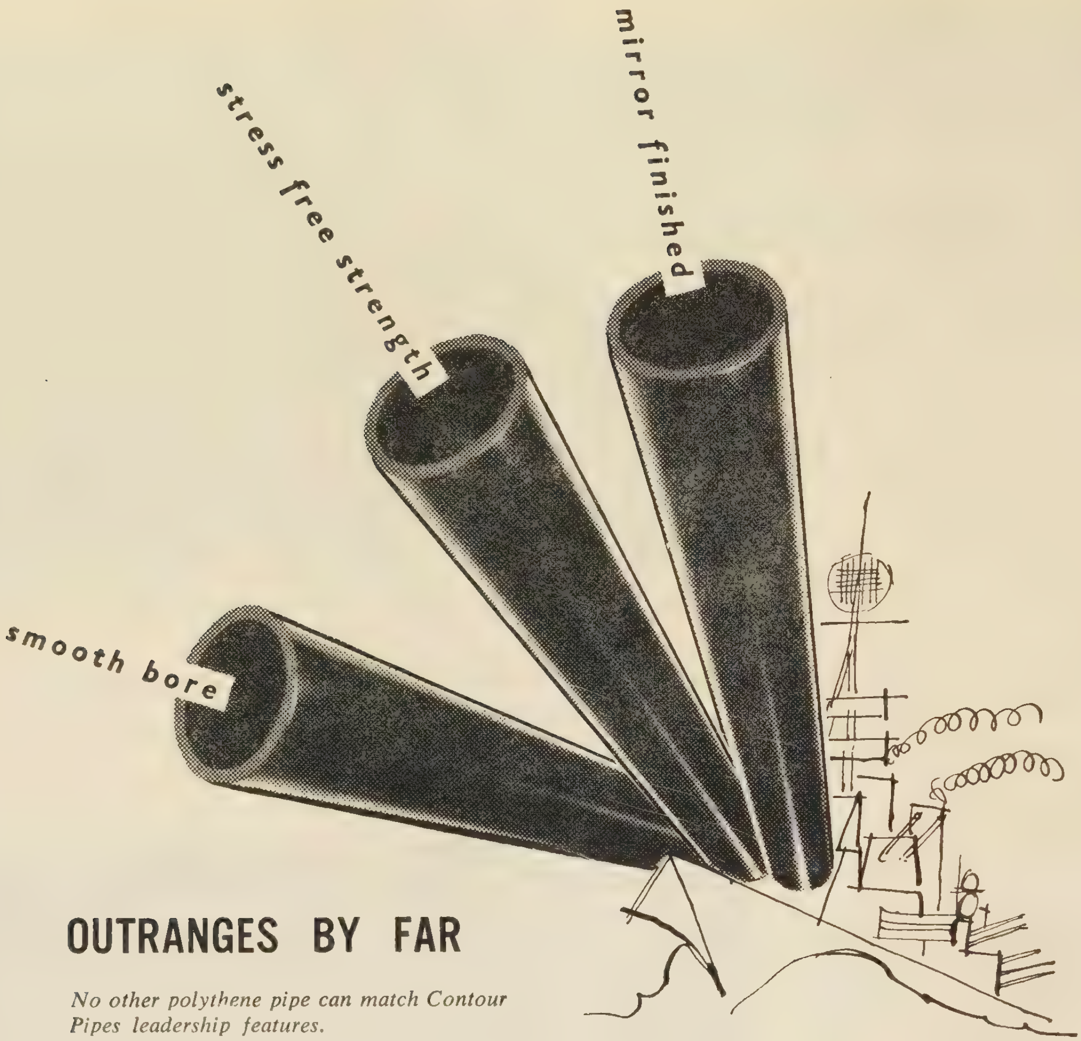
Cattle are carried to clean up roughage and control the pasture for ewes and lambs. Forty-five yearling heifers are bought in each year, usually in October, and kept for 20 months and sold fat in early June. About 90 cattle are carried in summer when cattle feed is plentiful and 45 in winter when feed is short.

This system of buying in yearling heifers and selling them fat to butchers at two and a half to three years has been found to be much more flexible than keeping breeding cattle and almost as profitable. At one time breeding cows were kept, but a major problem was that the cows got too fat. Overfat cows were difficult to get in calf and those that did tended to have a lot of trouble at calving.

Stock Health

The general thrift of stock is very good. Copper or cobalt as licks or drenches or applied by topdressing has not been found necessary to promote stock health.

Vaccination for pulpy kidney and blackleg is standard practice. The lambs are vaccinated against scabby mouth when three weeks old, because the incidence of scabby mouth in unvaccinated lambs in previous years was very heavy. The high incidence of scabby mouth may be due to the prevalence of Californian thistle, which could cause skin abrasions when the lambs were grazing close to the thistle and allow the entry of scabby mouth virus.



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There has been no record of facial eczema in the district.

Cropping

About 8 to 10 acres are put into crop each year. The paddock selected for the crop is ploughed out of grass in November after close grazing and sown to swedes in the second week of December. If boulders are present in the paddock, they are shifted across to the fenceline with a bulldozer before cultivation begins.

The swedes are sown in 7 in. rows with a roller drill at 1 lb per acre. The varieties of swedes usually grown are Sensation and Crimson King with an occasional crop of Wye. Four cwt of serpentine superphosphate per acre is sown with the crop. Good crops of swedes are usually obtained and the bulbs normally remain healthy up until feeding off is completed, except in an occasional year when some bulbs are affected with dry rot.

The swedes are fed off in breaks of about 2 acres from 20 July until the end of August. The ewes are put on to the crop during the day and taken off to a neighbouring grass paddock each evening. They have access to hay in racks in the grass run-off and eat about six bales of hay a day.

After the swedes are finished the paddock is cultivated and sown to chou moellier in November. Chou moellier is taken as a second crop because the incidence of club root precludes a successful second crop of swedes. The chou moellier is sown through the roller drill at 3 lb per acre with 4 cwt of serpentine superphosphate.

The chou moellier is fed off in July and August, and when the crop is finished the ground is cultivated and sown to grass in October with 2 cwt of superphosphate and 2 lb of 100 per cent DDT per acre.

DDT is used to control grass grub. The friable, loamy soil is attractive to grass grubs and if an insecticide is not used, there is in most years a heavy population of grubs in the soil which not only restricts grass growth but weakens the rooting system so that the turf is readily pulled out by the grazing animal.

▲ Two-year-old heifers which were bought in as yearlings.

The 2 lb of 100 per cent DDT is effective for at least three years. In an experiment put down in the Raetihi district in 1948 (one of the very early trials with DDT in New Zealand) by A. R. Dingwall, now Fields Superintendent, Department of Agriculture, Christchurch, 2 lb of 100 per cent DDT effectively controlled grass grub for six years.

The seeds mixture at sowing down consists of certified strains of the following grasses and clovers:

	lb
Perennial ryegrass	23
Short-rotation ryegrass	6
Cocksfoot	4
Timothy	1
White clover	3
Cowgrass (broad red clover)	2
Total	39

The new grass has some weeds among it, notably Californian thistle and redshank (*Polygonum persicaria*), and these are cut with the mower in December when they are about 9 in. high. The mown forage is left to wilt before it is cleaned up with young cattle. The paddock is then closed up to grow feed for the lambs. By mid January there is a useful amount of growth from the white and red clover in the sward and this has proved to be good lamb fattening feed. Californian thistle is a problem on established pastures as well as in new grass in most years and the mower is used to control it.

▼ Boulders which were bulldozed across to the fenceline before cultivation.

Hay

About 12 acres of hay are made each year, sufficient acreage being cut to get 1,000 bales. The paddock is closed at the beginning of November and is cut at the beginning of January. The baled hay is fed out over winter to the cattle at one bale to six cattle and to the ewe flock on the grass run-off when they are on the swede or chou moellier crop.

Drainage

The topsoil is friable and free draining and on the mounds and higher portions of the rolling country there is no problem with drainage. Wetness becomes a problem only in the low lying areas of the farm and this is associated with an impervious grit pan about 3 ft below the surface.

The method of drainage is to use tiles in subsidiary drains and lead them into open main drains which for convenience are situated along fencelines. The main drain is double fenced (fences 8 ft apart) and planted with *Thuya plicata* at 4 ft intervals or Lawson's cypress. The trees are planted on the side of the drain opposite where the tiles enter to prevent the tree roots getting into the drains and blocking them. The trees

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overgrow the drains and stop the light getting into the drain and in consequence there is very little weed growth on the sides and bottom of the drain. The trees also provide valuable shelter, an important phase of farm management in the Waimarino.

Fertiliser Requirements

The fertiliser used on the farm up to the present has been superphosphate at 2 cwt per acre. In recent years, however, field research on the Ohakune ash soils by the Farm Advisory Division of the Department of Agriculture has shown that good responses are obtained from an annual dressing of ½ cwt of muriate of potash in addition to the normal dressings of phosphate.

Potash at up to 2 cwt annually gave better responses than the ½ cwt dressing, but ½ cwt was sufficient to give a worth-while response. It is stressed that potash responses are obtained only after the phosphate level has been built up with fairly regular topdressing with superphosphate.

Mr Ritchfield's future topdressing programme will include potash and this will be applied with phosphate in potassic serpentine superphosphate (33 per cent mix) at 2½ cwt per acre.

Mr Ritchfield has not applied any lime since taking over the farm. In trials put down by the Farm Advisory Division on several farms in the district the application of lime has, at best, produced only doubtful pasture responses; lime applications varied between 5 cwt and 2 tons per acre.

The question of applying lime on the Raetihi-Ohakune soils is keenly discussed among farmers. Some successful farmers apply lime and others, just as successful, do not. The main claim in favour of lime is that limed pastures "do" stock better, particularly in regard to bone development.

Soil tests indicate a reasonable supply, though by no means an over supply of lime. Typical figures for the district for land that has had no previous topdressing are:

pH	Calcium level	Potash level	Phosphate level
5.9 (medium)	8 (medium)	6 (medium)	1 (very low)

The pH and the calcium level jointly determine the lime status of the soil. The pH is a measure of the acidity of the soil; it is an inverse measure in that the degree of acidity declines as the pH figure increases. A desirable pH for plant growth is about 6.1.

Apart from the use of boron to combat brown heart in swedes, none of the so-called minor elements has been used in pasture topdressing. A trial was put down on a neighbouring farm in 1954 with molybdenum, sulphur, manganese, magnesium, boron, copper, zinc, and vanadium, but gave no pasture responses from these elements.

▲ The woolshed and yards.

▼ Close-up of pasture recently closed for hay, showing a good base of certified white clover.

Subdivision and Water Supply

The farm is subdivided into 14 paddocks by standard seven wire fences. An electric pump is used to pump water for the stock from a well into a reservoir on the highest point of the farm. The water is then gravity fed to all paddocks on the farm.

Farm Buildings

The farm buildings consist of a woolshed (two-stand plant) and yards, cattle yards, a hay shed (1,200 bales capacity), and an implement shed.

Farm Labour

Mr Ritchfield is a member of a farmers' group who collectively employ a man. The employee is available to each member of the group for a fortnight every six months. A farmer who is ill has first call on the employee's services. Use is also made of neighbours' labour, particularly for haymaking, when three neighbours combine their equipment as well as their labour. Among the three neighbours there are three mowers, three tractors, one truck, one bale loader, and one hay press.

CONCLUSION

Waimarino is one of the better fat lamb farming districts in New Zealand. Perhaps the outstanding feature is the good thrift of stock, and this coupled with the fact that there has been no record of facial eczema makes the district attractive for fat lamb farming.

ROUND THE RESEARCH STATIONS

Current Work and Findings in Department of Agriculture and Department of Scientific and Industrial Research Trials and Experiments

Ruakura

Silage Investigations

Forty per cent or more of the food nutrients in pasture may be lost during the making of grass into silage. Trials at the Ruakura Animal Research Station indicate that the tightness with which the grass is consolidated in the silo has a marked effect on the extent of these losses.

Heavy consolidation results in a cold fermentation with appreciably lower losses and a better quality product than from light consolidation in which the temperature rises to blood heat or higher. Contrary to these experimental findings farmers sometimes obtain undesirable types of silage after heavy consolidation. This is believed to be due to factors other than the degree of consolidation.

To get further information on this problem two lines of investigation are at present being made. One involves a detailed study of the way in which various characteristics and constituents of herbage affect the type of silage made. The other aims at defining in more precise terms the role of aeration and temperature in the fermentation process.

Soil Bureau

Comparison of Potassium Fertilisers

When an actively growing pasture is topdressed with muriate of potash it rapidly absorbs much more potassium than it needs. This "luxury consumption" of potassium, attributed to the high solubility of the fertiliser, is one reason for the short-lived response of pastures to potash topdressing on yellow-brown loams in North Taranaki.

A pot trial has been run to compare muriate of potash with two new potassium fertilisers of lower solubility—potassium bicarbonate and potassium metaphosphate. The soil was New Plymouth black loam with white clover as the indicator plant.

The two new fertilisers yielded as much clover as did muriate of potash. However, despite their lower water solubility, "luxury consumption" of potassium by the clover was just as pronounced as with muriate of potash.

Invermay

Lamb Fattening with and without Ryegrass

In January 1958 six small paddocks were sown to pastures of widely differing composition to study the production and lamb-fattening capacity of pasture mixtures from (1) a high rate of a mixture of perennial and short-rotation ryegrass (30 lb per acre) with timothy, cocksfoot, and clovers; (2) a low rate of ryegrass (8 lb per acre) with timothy, cocksfoot, and clovers; (3) no ryegrass, timothy (5 lb,) cocksfoot (5 lb), and clovers. Each treatment was duplicated.

In the spring of 1958 the paddocks were stocked at seven ewes per acre with single lambs. At this time the grasses were dominant; the clovers had not

HEADING PHOTOGRAPH: A battery of experimental silos being filled at Ruakura.

established sufficiently to contribute appreciably to the diet of the sheep.

The 1958-59 season was exceptionally dry, but lamb growth until weaning was very good, averaging over 0.6 lb per head per day. There were no significant differences in growth rates between any of the different pastures, nor did any differences develop among groups of weaned lambs put on in January 1959.

The spring of 1959 was also very dry and the stocking rate was reduced to six ewes per acre with single lambs. All lambs were drafted in December, when the lambs from the no ryegrass paddocks averaged 6 lb per head heavier (live weight) than those from the ryegrass paddocks. The killing sheets showed an average of 175 lb per acre meat production from the ryegrass paddocks, compared with 194 lb per acre from the no ryegrass paddocks.

As the value of various grass species for lamb fattening seems to vary with seasonal conditions, it will be necessary to continue and extend this work before any clear-cut superiority of one pasture mixture over another can be established.

Hop Research Station

Breeding of Varieties Tolerant to Root Rot

The Californian variety of hops introduced from the Pacific coast of the United States at the turn of the century is grown in New Zealand. Varieties brought from Britain by the early settlers were grown before that, but the "Cali" quickly replaced them, as it yields much better in our climate, though odd hills of the English varieties can still be found in almost any hop garden.

According to local hop growers the Cali remained quite healthy in the early years, but some 25 years ago a serious disease developed rather rapidly, mainly in gardens which have a high water table for appreciable periods of the year.

The disease, which was given the name of root rot, appeared to be caused by a soil fungus of the genus *Phytophthora,* belonging to the *Phycomycetes,* whose members are noted for causing "blights" in several other crops. The soil fungus enters the hop hill at its crown, killing it gradually or quickly, depending on conditions which are still largely unknown.

The breeding of a new variety of hops is more difficult than that of a great number of other plants because the hop is dioecious (either male or female), so that established hop varieties are hybrid for the genetic factors observable in the plants. For commercial growing this does not matter, because the plants are multiplied by cuttings and so remain constant, but when the plants reproduce from seed this impurity is disclosed and none of the seedlings will show all the characters of the parents. For producing entirely new hops this is a welcome circumstance, but at the same time it obviously makes the improvement of an existing variety, such as introducing the gene(s) responsible for tolerance to root rot into the Cali, a very complex operation.

From 1952 some 6,000 seedlings from controlled crosses—Cali female x tolerant males, from first-back crosses to Cali, and from inter-crosses between seedlings of the first generation—have been grown in seedling gardens interplanted with Cali as controls. Promising female seedlings were tested in the laboratory for susceptibility to root rot; they were harvested individually and their hops were dried, weighed, and sampled for quality analysis. Tolerant seedlings showing promise over two consecutive seasons were propagated by layering and compared with Cali in variety trials. Those which compared favourably were approved for release to growers.

At present two seedlings—First Choice and Calycross—have passed all these tests and have been available to hop growers this spring.

Rukuhia

Magnesium in Pastures

Studies of magnesium needs of various plants have been greatly facilitated at the Rukuhia Soil Research Station through the development of a rapid and reliable atomic absorption method of analysis for magnesium.

A large number of analyses for magnesium have been carried out over the past 10 years, but no systematic attempt has been made to determine the seasonal variation in levels, though there is evidence that these changes may be considerable. A project is in hand to examine such changes and the seasonal influence of potash topdressing on magnesium levels.

Wallaceville

Selenium Responses in Lambs

Field trials with unthrifty lambs suggest that the kinds of soils on which selenium responses have been obtained tend to coincide in broad outline with those which are also deficient in cobalt. This may merely reflect the fact that these soils are ones from which nutrients generally are liable to be lost by leaching. Departmental trials at present in progress should give better definition of the soils on which responses to selenium can be expected and of the magnitude of the problem. Pasture samples are being taken from trial areas to see if there is any relationship between responses obtained in lambs and the selenium content of pastures.

◆

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TENAC FOR APPLICATION WITH	TO CONTROL WEEDS OR OTHER PESTS	SPRAY MATERIALS TO USE	AMOUNT OF TENAC	COMMENTS
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	WILLOWS	TENAC with SHELL Weedkiller "E" (Ester 2,4-D)		
	RUSHES	TENAC with SHELL Weedkiller "D" (Amine 2,4-D)		
FUNGICIDES	LATE BLIGHT of POTATOES and TOMATOES RUSTS MILDEWS LEAF SPOTS of VEGETABLES	TENAC with Copper or Preferred Fungicide		FUNGICIDES FORM A COMPLETE PROTECTIVE PLANT COVER WITH TENAC. Fungicide spray deposits resist rain, wind, and plant rubbing, when TENAC is added to the spray.
INSECTICIDES	POTATO TUBER MOTH (Potato Worm)	TENAC with DIELDREX 15		INSECTICIDES LEAVE NO PARTS UNPROTECTED WHEN USED WITH TENAC. AS TENAC increases the persistance of insecticides, do not use on edible parts of plants.

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Home-made Liquid Feeds for Trickle-irrigated Glasshouse Tomatoes

By
A. B. WEBSTER, Scientific Officer, and
W. R. BOYCE, Superintendent, Department of Agriculture Horticultural Research Station, Levin

CHEAP, easily prepared liquid fertilisers suitable for application in a simple, straightforward feeding programme for glasshouse tomatoes have been tested over two seasons at the Horticultural Research Station, Levin. Home-made liquid feeds that used raw materials which are cheaper than proprietary mixtures gave results as good as or better than one such product. Further, crops planted in early September and fed with one type of feed at one dilution throughout the season gave yields as good as those watered in the usual way with feeds of different compositions delivered at a range of dilutions. This can simplify management under trickle irrigation.

GLASSHOUSE tomatoes grown with trickle irrigation are watered nearly every day with from ½ pint to 3 pints of water per plant. It is usual to apply soluble fertilisers containing nitrogen and potash in the irrigation water, while phosphates are applied as a base dressing worked into the soil before planting.

When the plants are small they are watered sparingly. It has long been accepted practice to use feeds containing more potash than nitrogen at this stage and to apply them at a higher concentration than later in the season. As the plants grow the amount of water per plant is increased, the feed is diluted more, and the proportion of nitrogen in the feed is increased.

A fertiliser used for liquid feeding must have the following characteristics:

1. Be readily soluble in water at normal glasshouse temperatures.
2. Contain a high percentage of nutrients—nitrogen or potassium or both.
3. Be readily available as a high-grade pure material.
4. Be free of impurities toxic to plants.
5. Be compatible with any other fertilisers used in the solution.
6. Must not leave undesirable residues in the soil.

TABLE 1—MATERIALS SUITABLE FOR USE IN LIQUID FEEDS

	Per cent nitrogen (N)	Per cent potassium oxide (K_2O)	Amount soluble in 10 gal. water lb
Potassium nitrate ..	13.8	46.9	20
Ammonium nitrate	34.5	0.0	200
Urea	46.0	0.0	Very soluble
Ammonium sulphate	20.0	0.0	70

Four materials which fulfil these requirements are listed in Table 1 with their nitrogen and potash contents and their solubilities in water.

Potassium nitrate is the only material which contains both nitrogen and potash and is readily soluble in water. It is readily available in grades of high purity which are suitable for use in trickle feeds, but the use for which the material is required should be specified, as lower grades of this fertiliser unsuitable for liquid feeds are also marketed. It is the basic material of most liquid feeds used for trickle irrigation, but does not contain enough nitrogen for the optimum growth of the tomato plant.

Fertilisers containing nitrogen only must be added to the solution to bring the nitrogen content up to the required level. One part of nitrogen to two parts of potash, and equal parts of nitrogen and potash are the proportions usually used in these liquid feeds. Three materials can be added to provide nitrogen: ammonium nitrate, urea, or ammonium sulphate.

Ammonium nitrate is readily soluble and can be obtained in New Zealand as a chemical of 98.6 per cent purity. Its main disadvantage is that it is rather unstable; it is highly inflammable when mixed with organic matter and can be highly explosive if exposed to fire. There are restrictions on its storage in quantities over 7 tons. The transport and storage of ammonium nitrate are thus attended

The experimental glasshouse at Levin. Water was led through the water meter to the header tank. Each of the five downpipes was fitted with a tap and led to a diluter bottle. Each of the five treatments had its own diluter bottle.

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by difficulties and the pure material is not always freely available.

However, mixtures of ammonium nitrate and lime are obtainable under various proprietary names. Solutions of these materials can be used in liquid feeds for trickle irrigation, but the lime, which is practically insoluble, must be removed from the solution by filtration or decanting. Such solutions have been used at Levin for short periods when the pure material was not available.

Ammonium nitrate contains both nitrate and ammonium nitrogen, which may be an advantage. It contains no toxic impurities and leaves no harmful residue in the soil.

Urea has a high nitrogen content, is readily soluble, and is available commercially in a satisfactory grade of chemical. Urea of inferior quality is likely to contain an impurity called biuret which is highly toxic to plants. Damage is likely to occur if more than 1 per cent of biuret is present as an impurity. Grades marketed for use as fertilisers contain 0.2 per cent of biuret or less and are sold as biuret-free urea.

Ammonium sulphate is readily available as sulphate of ammonia, which can be obtained in a satisfactory grade. Its solubility and nitrogen content are lower than those of urea or ammonium nitrate. It has the disadvantage that when it is mixed with solutions of potassium nitrate, potassium sulphate is formed by double decomposition and recombination.

Because the solubility of potassium sulphate is rather low (7 lb in 10 gallons of water), it tends to crystallise out unless the solutions of ammonium sulphate and potassium nitrate are only a third as concentrated as those usually used for trickle irrigation liquid feeding.

Trials at Levin

Experiments at Levin during 1958-59 and 1959-60 compared solutions made from the above materials with a proprietary liquid fertiliser. An unheated aluminium house 102 ft x 30 ft running ESE to WNW on Levin silt loam (soil type 76) was used.

Before the experiments began the topsoil was removed, the subsoil levelled, and the topsoil replaced uniformly. As small single-row plots had to be used, the plants and soil in any one plot were isolated from the next plots by placing a barrier of black polythene film half way between the rows of plants to a depth of 2 ft 6 in.

Plants were raised according to good commercial practice: germinated in John Innes Seed Compost at a night temperature of 60 to 62 degrees F and potted off into John Innes Potting Compost No. 1 immediately after germination. The night temperatures were lowered to 52 to 54 degrees F eight to 12 days after germination and again 10 days later to induce the formation of good bottom trusses.

Planting was done at the beginning of September in rows 3 ft apart with plants 1 ft apart in the rows. The rows ran across the width of the house with a 4 ft central pathway. Plants were trained up strings on the single-stem system. The first two or three trusses of fruit were set by using hormone fruit-setting sprays. Therapeutants were applied at low volume, using compressed air and a paint spray gun.

The base manures applied to the whole glasshouse were:

	1958-59 Per acre	1959-60 Per acre
Ground limestone ..	4 tons	2½ tons
Dolomite	—	2½ tons
Serpentine superphosphate	44 cwt	44 cwt
Bonedust	25 cwt	25 cwt
Sulphate of potash ..	10 cwt	10 cwt
Sodium molybdate ..	—	2½ lb

Design of the Trials

Plots consisted of one row of plants half the width of the house—13 plants in all. There were five trickle-feed treatments on each of two varieties, making 10 treatments in all. These were randomised and replicated six times. There were guard rows at the ends of the house. The same two varieties were used in both seasons, Potentate (New Zealand Department of Agriculture strain) and V-548.

Liquid Feed Treatments

The liquid feed treatments compared in 1958-59 were:

1. A proprietary liquid fertiliser used according to the manufacturer's instructions. This high-potash feed (4.5 per cent N and 9 per cent K_2O) was applied at a dilution of 1 in 150 of water rising to 1 in 300, followed by an intermediate feed (9.7 per cent N and 8.3 per cent K_2O) at 1 in 300 rising to 1 in 600 and, if needed, a few high nitrogen feeds (20 per cent N and 7 per cent K_2O) in the middle of the season.

2. Mixtures of urea and potassium nitrate of the same compositions and applied at the same dilutions as treatment 1.

3. Mixtures of ammonium sulphate and potassium nitrate applied as in treatment 2 except that the strength of the concentrate was reduced to a third (the high potash mixture was 1.5 per cent N and 3 per cent K_2O) and the dilution rates were altered to 1 in 50 instead of 1 in 150 to provide the same amount of nitrogen and potash to the plant.

4. A mixture of ammonium nitrate and potassium nitrate applied at a constant composition (8.1 per cent N and 7 per cent K_2O) and a constant dilution (1 in 300) throughout the season.

5. A mixture of ammonium sulphate and potassium nitrate applied at a constant composition (2.7 per cent N and 2.3 per cent K_2O) and a constant dilution (1 in 100) throughout the season.

For the 1959-60 experiment the following treatment changes were made:

5: The composition was altered to 3.2 per cent N and 2.8 per cent K_2O.

6: Mixtures of ammonium nitrate and potassium nitrate, applied as in treatment 1 above, were substituted for treatment 2.

7: A proprietary liquid feed applied at a constant composition (9.7 per cent N and 8.3 per cent K_2O) and a constant dilution (1 in 300) throughout the season was substituted for treatment 4.

Experimental Set-up

The experimental set-up in the glasshouse is shown in accompanying illustrations. Water from the mains was led through a meter to an overhead tank fitted with a ballcock valve. Each of the five downpipes was fitted with a tap and led to an 18-pint bottle of concentrated liquid feed. These bottles were fitted with diluter heads. Each bottle was connected by its own mains hose to trickle irrigation lines laid out along the plots which were to receive that particular treatment.

Unfortunately, the full equipment was not available until the end of October 1958. Until then all plots had received the high-potash proprietary liquid feed at a dilution of 1 in 150. The different treatments were started on 31 October and treatments 1 to 3 were changed to the intermediate feed at a dilution of 1 in 150. This was increased to 1 in 200 on 8 January 1959.

During 1959-60 the "variable" treatments were given high potash feeds at 1 in 150 until 16 November, when the dilution was increased to 1 in 300. Intermediate feeds were introduced at 1 in 300 on 24 November. On 10 February the dilution was increased to 1 in 500. The actual amounts of nutrients applied are given in Table 2.

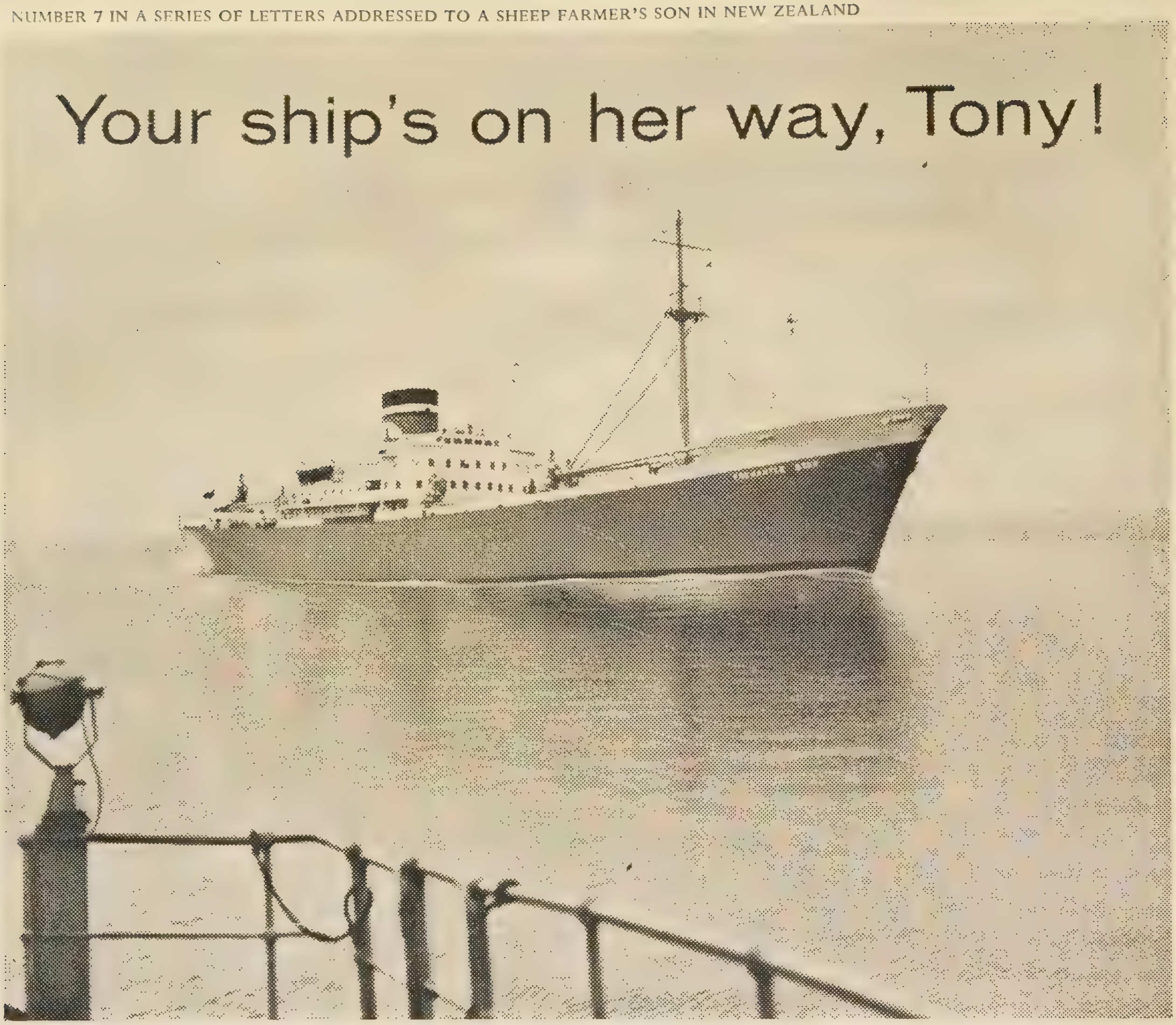
TABLE 2—AMOUNTS OF NUTRIENTS APPLIED

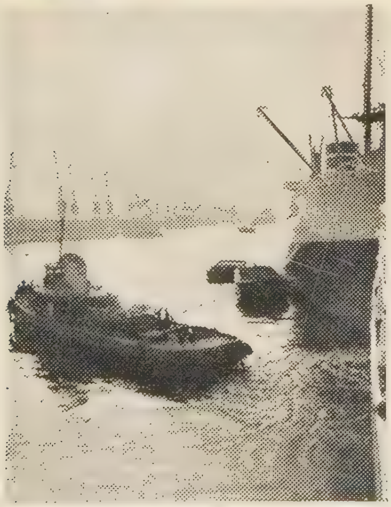
	oz per plant			
	1958-59		1959-60	
Treatment	N	K_2O	N	K_2O
1 ..	1.87	1.94	1.25	1.41
2 ..	2.34	2.34	—	—
3 ..	1.84	1.94	1.34	1.53
4 ..	2.14	2.19	—	—
5 ..	1.06	1.25	1.40	1.22
6 ..	—	—	1.34	1.51
7 ..	—	—	1.41	1.21

The amount of water required by the plants was estimated daily with soil tensiometers inserted in the ground and from prevailing weather. The quantity of water required was measured by the meter. The overhead tank with its five outlets ensured

NUMBER 7 IN A SERIES OF LETTERS ADDRESSED TO A SHEEP FARMER'S SON IN NEW ZEALAND

Your ship's on her way, Tony!





It was getting on for five o'clock before we got the last of the cargo stowed in **'FREMANTLE STAR'**. To the stevedores and dockers, there was nothing special about it: just another ship to be loaded and cleared for somewhere on the other side of the world. But we knew better; *we* knew that this was the start of a maiden voyage. As the sun went down over London, **'FREMANTLE STAR'** moved slowly out of the docks, into the river and headed for the sea. Tilbury slipped past . . . and Southend . . . and the Nore. The Straits of Dover were left astern. The channel pilot was dropped at Dungeness. And **'FREMANTLE STAR'**, latest addition to the ships of the Lines, was on her way. One of these days, Tony—you'll look out of your windows—and you'll find your ship has come in, right into your own port at Napier.

And that is the end of the story—or its beginning. For new ships of the Lines are always being built, to increase our service or replace those vessels whose useful life is ending. To their construction goes the skill and strength and toil of hundreds of men who will never see New Zealand. Yet they are no strangers to New Zealand produce; you, who are our customers, see to that. And the ships which these unknown men create are the link, bringing butter, meat, wool, fruit and cheese to Britain and British goods to you.

NEW ZEALAND OVERSEAS SHIPPING LINES

SHAW SAVILL & ALBION CO. LTD · NEW ZEALAND SHIPPING CO. LTD · PORT LINE LIMITED · BLUE STAR LINE LIMITED an equal flow through each of the five trickle systems. Other records kept included the minimum and maximum air temperatures and the soil temperature. Sunshine hours were recorded by a Campbell-Stokes recorder 20 yd from the glasshouse.

Fruit picking began in the middle of November and continued until the beginning of March. The fruit was graded into salable and unsalable and salable fruit was graded for size.

In 1958-59 the blotchy ripened fruit was weighed, but in 1959-60 their numbers were recorded. The salable fruit was scored for shape and uniformity of colour.

The results are summarised in Tables 3 and 4. They show quite clearly that the liquid feed treatments had very little effect on the yield or quality of fruit. In 1958-59 the only differences were the higher yield produced by the ammonium sulphate and potassium nitrate mixture used at a constant composition and dilution and the very slightly lower amount of blotchy fruit produced by the proprietary liquid feed. In 1959-60 the proprietary liquid feed used according to the manufacturer's instructions (treatment 1) and used at a constant composition and dilution (treatment 7) gave lower yields of salable fruit than the other materials.

Results

TABLE 3—RESULTS OF 1958-59 EXPERIMENT

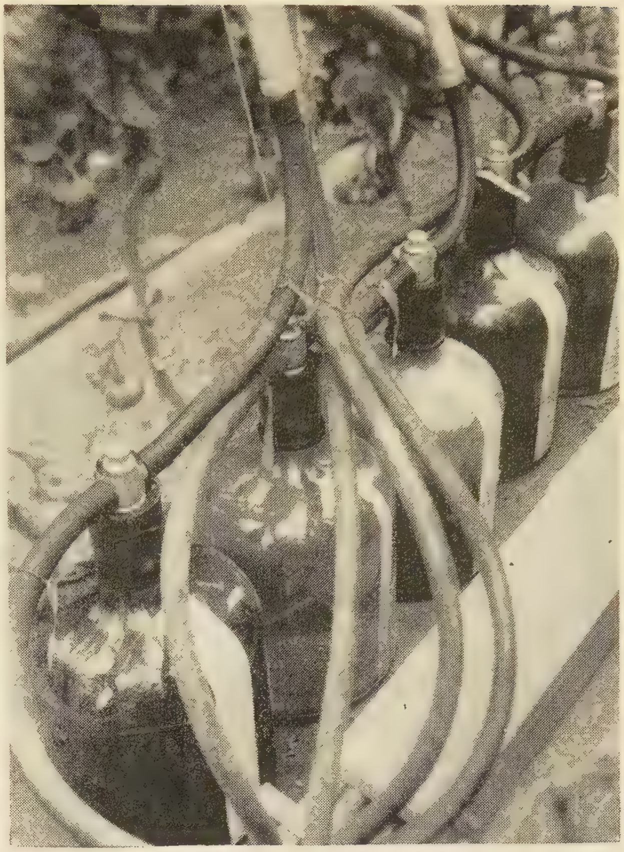
Treatment	Yield per plant (lb) Salable fruit	Yield per plant (lb) Blotchy fruit	Shape score
Feed 1 ..	10.68 b*	0.34 b	73.1 a
Feed 2 ..	10.23 b	0.44 ab	72.8 a
Feed 3 ..	10.70 b	0.43 ab	72.0 a
Feed 4 ..	10.81 b	0.66 ab	72.1 a
Feed 5 ..	11.54 a	0.69 a	71.9 a
Variety			
Potentate ..	10.99 a	0.88 a	73.6 a
V-548 ..	10.59 a	0.15 b	71.2 b

* Any two treatments are similar if they have any letter in common; if not, they differ significantly.

TABLE 4—RESULTS OF 1959-60 EXPERIMENT

Treatment	Salable yield (lb per plant)		No. of blotchy fruit		Shape score		Colour score	
	Potentate	V-548	Potentate	V-548	Potentate	V-548	Potentate	V-548
1	9.06 b*	9.96 a	368	171	389	372	428	457
3	9.50 ab	10.13 a	412	208	388	380	416	460
5	9.60 ab	9.86 a	411	188	390	381	415	460
6	10.17 a	10.02 a	425	172	388	373	414	453
7	9.19 b	9.62 ab	424	191	393	377	420	451

* See footnote Table 3



The diluter bottles. For each experimental treatment there was a downpipe leading to an 18-pint bottle fitted with a diluter head. From the diluter bottle the diluted feed was led to the trickle lines by mains hose, one for each treatment.

In 1958-59 there was no significant difference in the yields of the two varieties, but Potentate gave more blotchy fruit than V-548. The shape of Potentate was slightly better than that of V-548.

In 1959-60 V-548 gave significantly higher salable yield and less blotchy fruit than Potentate. Its colour was better, but its shape was slightly poorer.

These results show quite clearly that there is no need for the tomato grower to depend on proprietary liquid feeds. As good, if not better, results can be obtained by the use of home-made mixtures. Further, there is no need to alter the composition or the dilution of the feeds during the growing season for a cold-house crop planted in early September. This finding may not hold true for earlier crops or for crops planted in autumn. Further experiments will be carried out to see if a feed of constant composition and dilution can be used for these crops which are grown under more adverse conditions.

Making up liquid feeds on the nursery calls for a dry, weatherproof shed for storage of raw materials and a tank in which the feeds can be mixed and stored until required in the glasshouse. The tanks must be of non-corrodible material; stainless steel or glass is ideal. However, a 44-gallon oil drum, the inside of which is painted with three coats of corrosion-resistant or bitumen paint, will last for one season. The tank should be fitted with a tap to facilitate the filling of the diluter bottles.

Growers when making up liquid feeds are recommended to reduce the concentration to about three-quarters of that used in the trials (7.2 per cent N and 6.3 per cent K_2O as against 8.1 per cent N and 7 per cent K_2O) and to alter the dilution rate to compensate for the change (1 in 250 instead of 1 in 300). These weaker solutions are easier to prepare. No heating is necessary to dissolve the fertilisers and there should be no trouble with the fertilisers crystallising out in cold weather.

The mixtures containing ammonium sulphate are only one third the strength of those containing ammonium nitrate or urea; if they were stronger, potassium sulphate formed by double decomposition and recombination would crystallise out. The dilution rate must be altered (1 in 80 instead of 1 in 250) to compensate for this.

Colouring the liquid feeds with a dye is advisable as a precaution against underfeeding or overfeeding. Water-soluble eosin at 1 oz per 20 gallons of feed is quite satisfactory. Care must be taken not to spill the eosin on clothing, as it will leave a permanent stain.

The amount of nitrogen in these feeds is greater than the amount estimated to be removed from the soil by the tomato plant and is greater than is recommended for use under British conditions by the National

TABLE 5—COMPOSITION OF LIQUID FEEDS (WEIGHTS OF MATERIALS PER GALLON OF WATER)

Ingredients	Ratio and per cent of nitrogen to potash		
	1 : 2 3.3 % : 6.3 %	1 : 1 7.2 % : 6.3 %	3 : 1 17.6 % : 6.3 %
1. Potassium nitrate .. .. Ammonium nitrate ..	1 lb 8 oz 6 oz	1 lb 8 oz 1 lb 8 oz	1 lb 8 oz 4 lb 8 oz
2. Potassium nitrate .. .. Urea	1 lb 8 oz 4½ oz	1 lb 8 oz 1 lb 2¼ oz	1 lb 8 oz 3 lb 6¾ oz
	1 : 2 1.1 % : 2.1 %	1 : 1 2.4 % : 2.1 %	3 : 1 5.9 % : 2.1 %
3. Potassium nitrate .. .. Ammonium sulphate ..	8 oz 3½ oz	8 oz 13½ oz	8 oz 2 lb 8 oz

Agricultural Advisory Service. Experience at Levin has shown, however, that these larger amounts are necessary if plants are to make balanced growth. This is because of the greater amount of bright sunshine in New Zealand compared with England. If the English recommendations are followed here, the plants become "hard" and the leaves twisted and distorted.

Recommendations

At the Horticultural Research Station with crops planted in a cold glasshouse in September, a feed containing almost equal parts of nitrogen and potash can be used throughout the whole season. This practice is recommended for crops grown under similar conditions of season, soil, and climate. A suitable solution can be prepared by dissolving 1½ lb of potassium nitrate and 1½ lb of ammonium nitrate in 1 gallon of water. It should be used at a dilution of 1 in 250.

The constituents of other solutions which may be used as alternatives to this one are shown in the third column of Table 5. The feed containing potassium nitrate and ammonium sulphate which is lower in nutrient content for reasons previously explained should be used at a strength of 1 in 80 instead of 1 in 250. The amount of diluted feed given per plant will vary from ½ pint to 3 or 4 pints per day.

The quantity of potassium nitrate and ammonium nitrate required for feeding a 1,000-plant house for the season will be about 180 lb of each fertiliser. It is calculated as follows:

Each plant requires about 30 gallons of water in a season, or 30,000 gallons for a house with 1,000 plants. If concentrated liquid feed is used at 1 gallon to 250 gallons of water applied, the amount of concentrate used will be

$$\frac{30{,}000}{250} \text{ or 120 gallons.}$$

Then, as 1½ lb of potassium nitrate and 1½ lb of ammonium nitrate are added to 1 gallon of water to make up the concentrate, 120 × 1½ lb or 180 lb of each will be required.

The use of a feed with a fixed ratio of one part N to one part K_2O throughout the season has not been tested yet on autumn- or winter-planted crops in heated glasshouses or in glasshouses on other soil types. Growers' experience may show that solutions of different compositions and varying strengths are required under such different conditions. For this purpose the means of preparing solutions with other nutrient ratios are given in Table 5.

Small quantities of feed with 1 N : 2 K_2O can be applied at a dilution of 1 in 100 in the early stages of growth under low temperatures or reduced hours of sunshine. As the plants grow and require more water the dilution rate should be increased to 1 in 300 or 1 in 400. When the hours of sunlight increase and temperatures rise, a change to feeds containing 1 N : 1 K_2O can be made.

The feed containing 3 N : 1 K_2O may be used as an occasional stimulant or where soil conditions require a higher proportion of nitrogen to be applied. The dilution rates should vary from 1 in 100 to 1 in 600 for the mixtures containing ammonium nitrate or urea; that is, similar rates to those used at present with proprietary liquid feeds, whereas with mixtures containing ammonium sulphate the dilution rates would range from 1 in 40 to 1 in 200.

Acknowledgment

K. J. McNaught, Principal Scientific Officer, Rukuhia Soil Research Station, assisted in planning experimental work and advised on the preparation of suitable fertiliser solutions.

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Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during September 1960 and for the 2 months ended 30 September 1960 with comparative figures for the same month and the 2 months 1959-60 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage increase
September 1960	18,965	342	19,307	—
September 1959	18,909	316	19,225	—
Increase	+56	+26	+82	+0.426
2 months ended 30/9/60	31,265	513	31,778	—
2 months ended 30/9/59	29,445	450	29,895	—
Increase	+1,820	+63	+1,883	+6.298

Butter in store at 30 September 1960 was 14,619 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage increase
September 1960	6,844	1,764	8,608	—
September 1959	6,732	1,661	8,393	—
Increase	+112	+103	+215	+2.561
2 months ended 30/9/60	9,714	1,918	11,632	—
2 months ended 30/9/59	8,658	1,717	10,375	—
Increase	+1,056	+201	+1,257	+12.115

Cheese in store at 30 September 1960 was 8,434 tons

If these figures are converted into butterfat equivalent, there is an increase of 7.084 per cent in butterfat graded for the 2 months as compared with the preceding season. The above figures refer only to butter and cheese graded for export and do not include butter and cheese used on the local market and other products such as anhydrous milk fat, whole milk powder, and other whole milk products, and are not necessarily a true indication of production trends.

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CARROTS

Upper—Pulling and loading carrots for feeding out to pigs and cows. An advantage with carrots is that they can be left in the soil until they are required.

Above—Holmes Improved grows well out of the ground and can be harvested easily.

[*Photo News*

By A. C. BURGESS,

Assistant Fields Superintendent, Department of Agriculture,
Palmerston North

THE area of carrots grown for stock feeding in the whole of New Zealand is probably not more than 250 to 300 acres, and it is therefore a relatively unimportant crop in our economy. This is surprising, because carrots are very valuable for winter feeding of both dairy cattle and pigs, and because they resist disease, they are a fairly safe crop to grow. When the crop is sown in drills at a light seeding rate and is sprayed with power kerosene to control weeds excellent crops of 50 tons or more per acre can be produced without too much trouble and at reasonable cost.

IDEALLY, carrots are grown in a deep, light, fertile soil. The black or brown sandy loams of Taranaki, derived from volcanic ash, and the pumice soils of the Taupo-Rotorua area approach the ideal. In the latter area carrots may well become a popular crop. These soils are not naturally fertile, but they can be built up easily with fertilisers. Generally the areas covered by these soils have an ample, well distributed rainfall, which is essential for good crops of carrots. Heavy, poorly drained, or stony soils are not suitable and produce only stunted, badly shaped roots.

The best crops are grown straight after grass, and though some farmers will grow a crop of carrots in the same piece of ground for several years running, this is not wise.

VARIETIES

Carrots vary considerably in colour, size, shape, and habit of growth. They may be classified according to colour, which varies from white to deep yellow, but generally the shape or habit of growth is the basis for classification.

Long Varieties

Yellow Fleshed

Only two long yellow-fleshed varieties are grown to any extent now and the more popular of these is Holmes Improved. This is a big carrot with a circular crown about 4 in. in diameter and it tapers evenly to the tip. The average length of a good specimen is about 12 in. As the roots grow well out of the ground, harvest-

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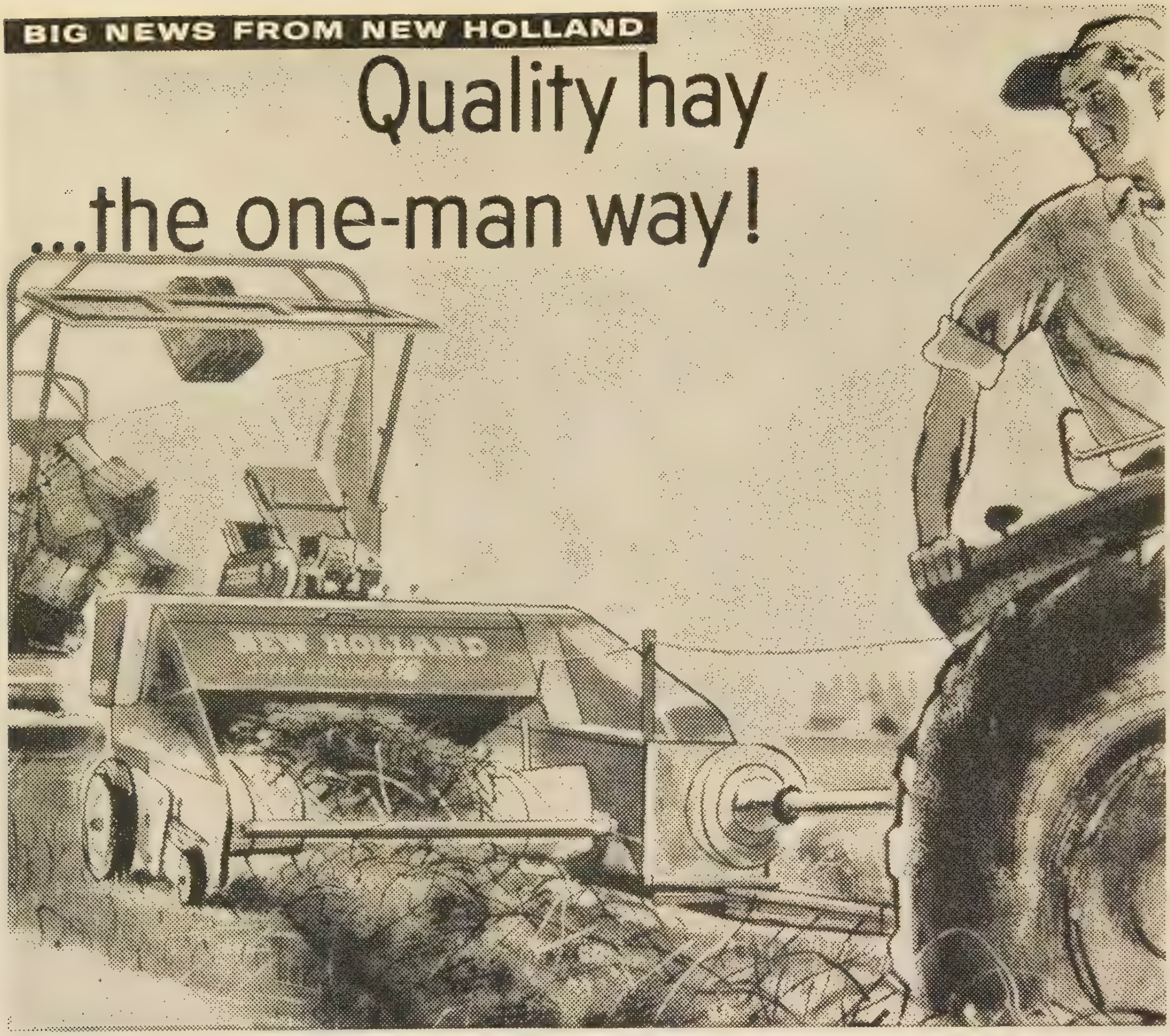

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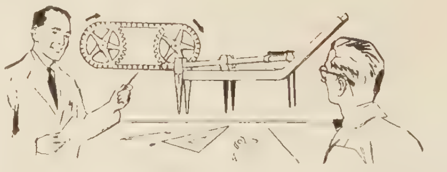

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ing is relatively easy. The flesh is medium yellow, and though there is a big proportion of "core", this is tender and palatable. It is an excellent cropper and is very resistant to attack by aphids.

This variety was developed in North Taranaki by Mr Holmes of Bell Block near New Plymouth about 50 years ago. It was bred from the variety known as Barriball, a square-necked, light-coloured, intermediate-type carrot, which was crossed with an English long red variety. By careful selection the type which was named Holmes' Improved was developed and has been maintained ever since.

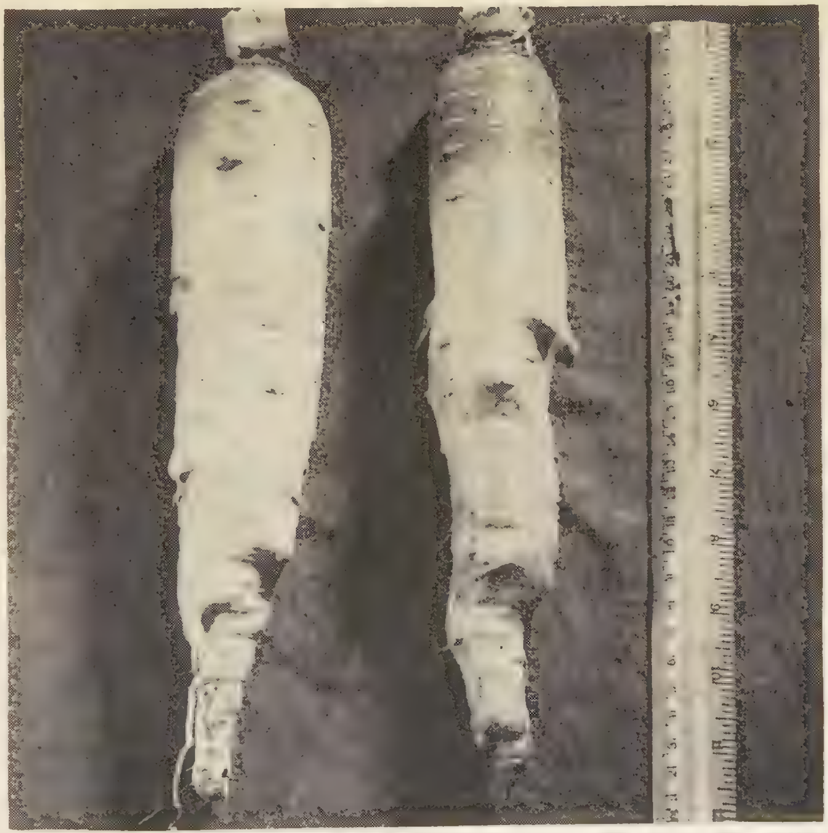
Yellow Belgian, the other long yellow type still grown, has only limited use and does not equal Holmes' Improved for yield or ease of harvesting.

White Fleshed

White Belgian, Matchless White, and Matchless White Belgian are all still obtainable.

White Belgian is a long, slender carrot, tapering little from the crown to the tip. It grows well out of the ground, but the roots are often badly shaped. Matchless White is larger crowned than White Belgian, tapers more, and does not grow so far out of the ground. It is generally considered the heaviest cropper, but is suited only to deep, freely draining soils and is rivalled in performance by Holmes Improved.

Carrots are a good winter → supplement for dairy cows.



Yellow Belgian has only limited → use and does not equal Holmes Improved for yield or ease of harvesting.

[Photo News

Intermediate Varieties

Intermediate varieties are now very rarely sown. They are more suited to shallow soils than the long varieties. Generally they have a circular crown 3 to 4 in. in diameter and their maximum length is about 8 in. They are all yellow fleshed. They are ideal for the shallower soils with a heavy silt or clay subsoil.

Red Intermediate, Scarlet Intermediate, Barriball, and Sinclair's Champion were the intermediate varieties usually grown. Red and Scarlet Intermediate are similar except for a variation in flesh colour and are good for shallower soils, but are difficult to harvest because they do not grow far out of the ground.

Barriball and Sinclair's Champion were both developed in North Tara-

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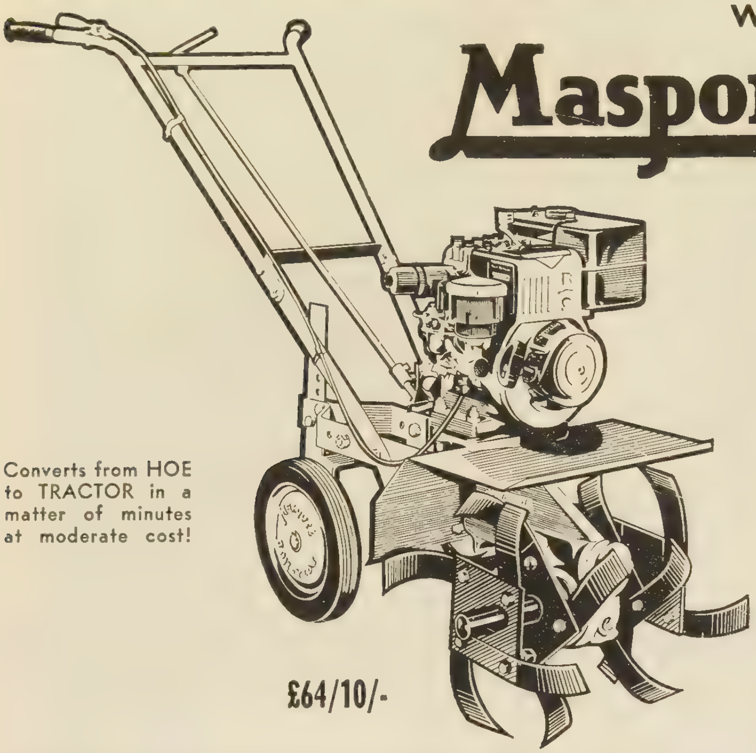

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naki and are similar in growth habit. The crown is wide with square shoulders and the carrot tapers quickly to a point. The flesh is light yellow.

Short Varieties

Guerande, also known as Oxheart, is the only short variety of any importance. The carrots have a wide crown and grow only 3 to 4 in. long, with practically no taper from crown to tip. For very shallow soils this variety is ideal and it is grown for sheep feeding and for bait for rabbit poisoning in parts of the South Island. It has a deep yellow flesh and is a good table variety.

Preparing the Ground

Land for carrots should be thoroughly prepared to destroy as many weeds as possible and to get a good, fine seedbed. When the carrots are sown after grass ploughing should be done at least two months before sowing and the land should be disced and harrowed until the ground is ready. Rolling should follow the last discing and harrowing.

Manuring

Carrots respond well to liberal manuring. Well rotted silage, shed manure, and liquid manure are sometimes used and are ideal. A mixture of superphosphate and blood and bone or bonedust (2 : 1) and one part of muriate of potash on potash-responsive soils, applied at 4 to 6 cwt per acre when the seed is sown, gives very good results.

Sowing the Seed

The seed is sown generally on the flat in 14 in. rows. In Taranaki 1 lb of seed per acre is normally sown with a hand drill and unless large areas are being sown this is quite satisfactory. When the seed is sown at this rate thinning is unnecessary. The seed is sometimes sown on ridges in 21 to 28 in. drills. The advantage of sowing on ridges is the ease of pulling the roots, which grow very big.

Sowing should be done in October or early November when soils and weather are suitable.

Weed Control

Cultivating for Control

When the crop is sown in wide drills on ridges intercultivation can be done with a tractor, but if only a small area is sown on the flat, a wheeled push hoe is generally used. Care should be taken in the early stages of the crop to keep weeds in check until the carrots become well established. This will ensure a good crop, whereas if weeds are allowed to smother the young carrots, the crop will almost certainly be a poor one.

Control with Kerosene

One of the reasons for the decline in popularity of carrots for stock fodder was the labour required in weeding and thinning. However, if the crop is sown thinly on ridges, little thinning is required and chemical weed control obviates the necessity for hand weeding.

Power kerosene is quite satisfactory for weed control and proprietary sprays of a similar nature can be used.

The most successful results have followed kerosene spraying of seedling carrots which have formed two permanent or "fern" leaves. In 24 to 48 hours most of the weeds are completely killed, leaving the carrots unharmed. There is no need to spray the whole area, as the weeds between the rows can be killed by intercultivation.

The proprietary sprays can be used without trial, but power kerosene, being variable in its chemical composition, may possess properties which make it injurious to the carrots. It is advisable, therefore, to spray a foot or two of a row and leave it for 48 hours. If results appear satisfactory, the whole crop can be sprayed.

Conclusions drawn from trials carried out in Taranaki and Hawke's Bay a number of years ago indicated that:

1. Spraying should be done as early as possible after the carrots reach the "fern" leaf stage and preferably when they are 1 to 1½ in. high. If left too late, the leaves spread out and prevent the spray reaching weeds growing in or right alongside the rows.

2. The pump used should deliver a fine, even application 6 to 8 in. wide. About 25 to 35 gallons of power kerosene per acre should be used, or if proprietary sprays are used, as per the directions.

3. Spraying is most effective if done when the weather is warm and dry. Where rain falls soon after spraying the control of weeds is far less effective. In a high-rainfall area like Taranaki ideal conditions are often difficult to strike.

4. Most of the common weeds in the carrot crop, such as docks, ribgrass, twin cress, and fathen, are completely killed when well sprayed.

It will be seen that this method of weed control is relatively cheap and very effective.

Harvesting

Carrots take six to eight months to reach full maturity. They can be fed out as a rule from May until July or August, and they have the advantage that they can be left in the soil until required to be fed. They are now rarely, if ever, stored in a clamp.

Generally about 10 to 20 lb per head per day is fed with grass to cows before calving or early after calving. For sheep, 7 to 10 lb per day is sufficient. Carrots for sheep feeding are generally fed off in breaks. Racehorse owners are keen to feed carrots when available and 7 to 10 lb per day fed with good oaten chaff is considered to be sufficient. For fattening store pigs 10 to 15 lb per pig per day, with some protein-rich food such as meat meal or pea meal, provides an excellent ration. One ton of carrots would therefore provide three months' feeding for two store pigs.

Yield

Yields of up to 70 tons per acre have been obtained in Taranaki under good conditions, but generally a yield of 40 tons per acre is considered good and the average is about 35 tons.

Saving Home-grown Seed

Good seed is essential for growing a good crop and some farmers who grow carrots regularly prefer to save their own seed. To do this successfully requires careful selection. The following extract from an article on selection of seed for root crops published in the "Imperial Agricultural Bureaux Joint Publication No. 5", July 1943, stressed this point:

"Carrot is a cross pollinated crop and isolation between varieties is necessary as well as isolation from wild carrot. While the distance maintained between varieties is sometimes not more than a few hundred yards, isolation of at least one mile has been recommended for the growing of stock seed."

The following is the best procedure for saving seed: from the mature crop carefully select carrots which conform in size, shape, and colour to the ideal for the variety. Any badly shaped roots or any in which the crown is sunken or uneven should be discarded, as such roots are more likely to develop soft rot in wet weather. The selected roots should be carefully stored and in September or October should be planted in a well prepared seedbed protected as much as possible from areas where other carrots are growing. The roots should be planted 12 in. apart. The seed heads should be cut off as they ripen and stored in a cool, dry place until fit for threshing. A further improvement could be made by keeping and sowing separately the seed harvested from each root. Probably the resultant roots will vary in type according to the genetic make-up of the parent, when any further roots for seed production should be taken from those lots showing the most desirable features. Yields of seed of from 600 to 800 lb per acre have been obtained in a seed-growing area.

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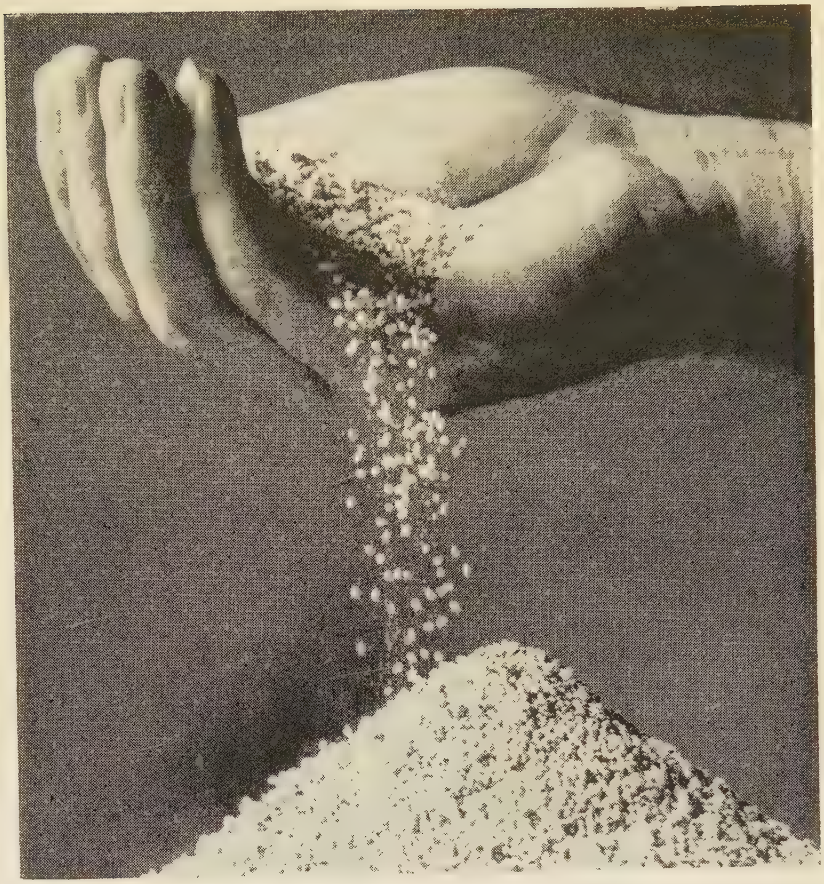
Inoculation and Pelleting of Clover Seed

By A. HASTINGS and
A. D. DRAKE,
Plant Diseases Division,
Department of Scientific and
Industrial Research, Auckland

IN recent years farmers have found that inoculation is essential for successful establishment of clover on lower fertility soil types, on tussock, and on hill country. However, the emphasis must be on effective inoculation, because disappointing failures have occurred. These have led to an investigation of inoculation techniques. Many acres of lower fertility land are at present being developed and very large areas are due for future development, so it is important that reliable inoculation methods be evolved as quickly as possible.



Experimental lime pelleted red clover seed.

FOR many years inoculation in New Zealand was restricted to lucerne and a simple reliable technique was used. Agar cultures supplied to the farmer by the Plant Diseases Division through seed merchants were diluted with skim milk and mixed with the seed shortly before sowing. Since 1955 commercially manufactured agar and peat cultures have also been used successfully with lucerne.

When the inoculation of clovers was begun the same method was used. It soon became evident, however, that because different sowing techniques were used for clover, there was a danger that the nodule bacteria placed on the seed would fail to survive the period between inoculation and germination. To overcome this it is necessary to inoculate with many more bacteria than in the past and then try by some method to keep them alive on the seed. Failures have occurred for the following reasons:

1. Inoculated clover seed has been held too long after inoculation.
2. Inoculated seed has been sown into very dry soil under dry, warm conditions.
3. Inoculated seed has been broadcast without adequate covering.
4. Inoculated seed has been sown in winter, months before germination could take place.

Tests with sticking materials and a peat culture containing large numbers of bacteria (1) demonstrated that the life of bacteria on seed could be prolonged, but this method was not efficient after long storage or under adverse sowing conditions. Experimental soil-pelleted white clover seed prepared by C. During of the Department of Agriculture gave encouraging results when tested. A method of inoculating and lime pelleting legume seed reported (2) from Western Australia showed that this treatment gave improved nodulation when inoculated seed was sown with superphosphate.

It was decided to follow up this work to see if pelleting substances were protecting the bacteria on the seed from adverse conditions.

In this series of experiments pellets have been prepared from many materials, including ground limestone, basic slag, superphosphate, clay, and several types of soil. These materials were stuck to seed with different types of adhesive materials including methyl cellulose and gelatine glue. Finally the value of placing the nodule bacteria inside or outside the pellet was tested.

Use of Methyl Cellulose

One of the simplest and most effective ways of making pellets is as follows:

Methyl cellulose, a cheap, readily available material, is made up as a 5 per cent solution with warm water (2 oz of methyl cellulose dissolved in 2 pints of water is sufficient to pellet 30 lb of seed). Then a proprietary peat culture and the sticker supplied with it are mixed with the methyl cellulose, and the seed is then tipped into the mixture. When this has been stirred thoroughly, the seed is ready for the pelleting material.

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sprinkled on to the inoculated seed. Further stirring rapidly brings about a separation into individual pellets as powder adheres to the sticky covering on each seed. When inoculation was incorporated outside the pellet the pellets were prepared first and the peat culture added last.

It was found during the tests that for effective nodulation a peat culture containing at least 500 million nodule bacteria per gramme of peat is essential. Tests carried out with a culture containing 60 million bacteria per gramme gave very poor results. Therefore a New Zealand manufactured peat culture containing at least 500 million effective bacteria per gramme was used in making experimental seed pellets.

Trials to date in the glasshouse and field with pelleted inoculated seed have been encouraging. In the glasshouse, tests were carried out in seedling agar tubes (see illustration at right) containing a jelly with nutrient salts present but no nitrogen. Samples of seed from the various treatments were sown in these tubes, one seed per tube, at intervals up to 92 days after inoculation. The percentage of seedlings with efficient nodules was recorded after four weeks. Results from one such test are presented in Table 1.

TABLE 1—WHITE CLOVER PELLETS IN SEEDLING AGAR TUBES

(Percentage of plants nodulated)

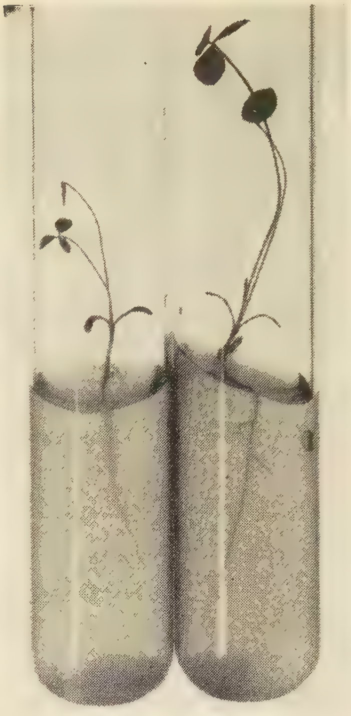
	Days between inoculation and sowing		
Treatment	**42**	**70**	**92**
Normal inoculation	66	0	0
Normal inoculation plus sticker	80	44	0
Soil-lime pellet inoculated inside	100	100	100
Clay-lime pellet inoculated inside	100	100	100
Lime pellet inoculated inside	94	88	100
Lime pellet inoculated outside	50	44	10

TABLE 2—WHITE CLOVER PELLETS IN PARAU CLAY LOAM IN POTS UNDER GLASS

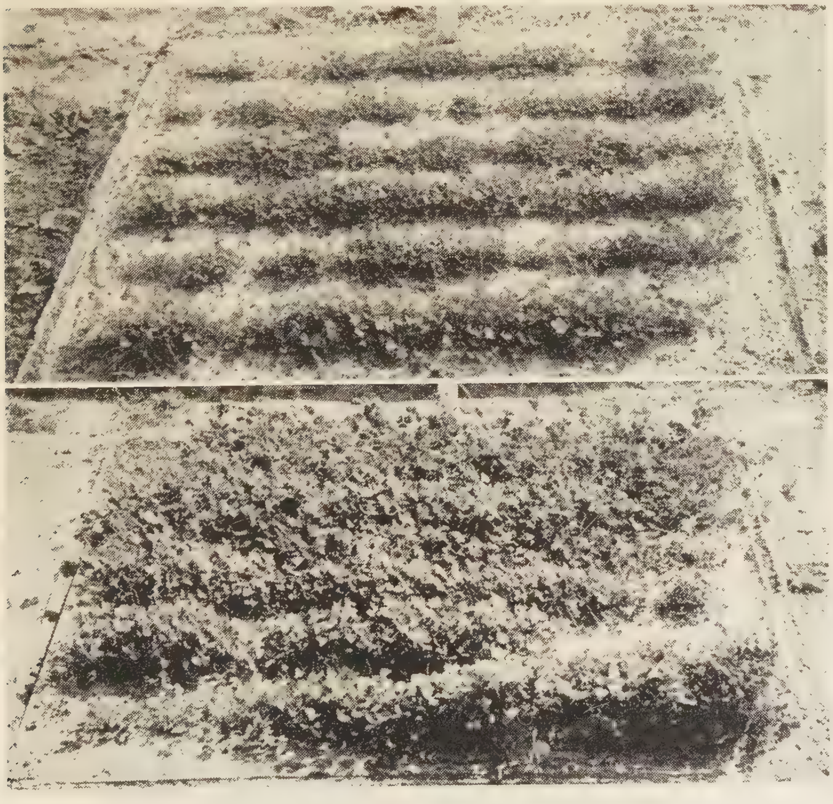
(Weight of tops of seedlings in grammes)

	Days between inoculation and sowing			
Treatment	**42**	**70**	**92**	**Total**
Normal inoculation ..	0.4	0.6	0.4	1.4
Normal inoculation plus sticker	0.4	0.6	0.4	1.4
Soil-lime pellet inoculated inside	7.6	5.2	5.2	18.0
Clay-lime pellet inoculated inside	8.2	6.3	4.2	18.7
Lime pellet inoculated inside	8.9	5.3	3.7	17.9
Lime pellet inoculated outside	2.2	0.8	0.8	3.8

Pots of a low fertility soil were also sown with treated seed at six, 10, and 13 weeks after inoculation. For pot experiments the weight of tops produced after 10 weeks was used as a measure of the degree of nodulation (Table 2).



Seedling agar tubes containing white clover seedlings. Left: Not inoculated. Right: Inoculated.



Field trial: Upper—Lime pelleted clover inoculated outside. Lower—Clay-lime pelleted clover inoculated inside.

In field trials plots were sown by broadcasting and drilling inoculated pelleted seed on a low fertility soil in late spring during dry, warm weather. The pellets had been held for 35, 49, and 63 days after pelleting and inoculation. These trials confirmed glasshouse results, the best pellets in the field being those that proved superior in the glasshouse. The inoculation was as effective when these pellets were prepared 63 days before sowing as it was when the seed was inoculated immediately before sowing.

Results from all tests (laboratory, glasshouse, and field) indicate that pelleting offers considerable protection to the legume nodule bacteria. Good establishment of clover was obtained on poor soil with pellets made from lime alone or from mixtures containing lime and soil and lime and clay.

The results also showed that nodule bacteria survived much better when the culture was incorporated inside the pellet. Further tests are in progress and large-scale field trials in cooperation with the Department of Agriculture are contemplated.

References

(1) "You can 'Stick' Bugs to Clover Seed Now", A. Hastings, "New Zealand Farmer", 21 September 1959.

(2) "A Method of Inoculating and Lime-pelleting Leguminous Seeds", W. P. Cass-Smith and Olga M. Goss, Bulletin No. 2,518, Department of Agriculture, Western Australia.

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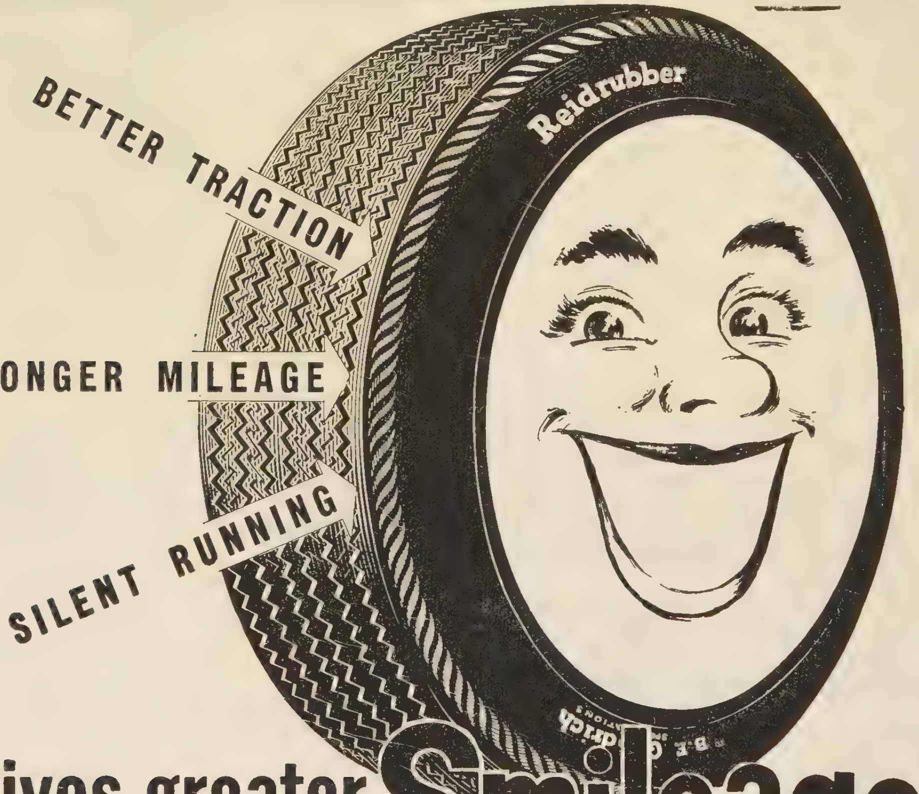
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Recent Research Work

Drainage, Cultivation, and Liming of Peat

IN developing raw peat the plan should be to produce a layer of peat in which the pasture plants may root freely. The essential requirements are that the top layer of peat must not be waterlogged in winter, the water table must not fall below about 18 in. in summer, and the acidity of the peat must be reduced sufficiently in about the top 8 in. to enable the roots to penetrate into the moist zones.

PASTURES on peat soils are more liable to suffer both from waterlogging in winter and lack of moisture in autumn than are pastures on mineral soils.

On poorly drained peat, spring growth of pasture does not start until the water table has dropped a few inches and the temperature has risen, and hence is later than on mineral soils. Maximum pasture production is usually in November or December, when there is still enough moisture in the top few inches of peat for vigorous plant growth. If dry conditions continue and the surface layers dry out, pasture production may be severely affected; brown, dead-looking pasture in summer is common on peat soils even where the water table is less than 18 in. from the surface. The dying out of the pasture is caused by the acidity of the peat below about 4 in., which prevents the penetration of the plant roots so that their growth is restricted to the top few inches of dry peat.

This acidity is found in most New Zealand raw peats, and consequently on many areas of peat the pasture is shallow rooted with practically no production during dry summers and autumns.

EFFECT OF SHALLOW DRAINS ON WATER TABLE

AT the Rukuhia Soil Research Station's peat area on the Moanatuatua swamp raw peat sown with pasture was drained with ditches 18 in. deep and 2 chains apart. For the past three years the level of the water table below the surface has been measured in holes at different distances from the drains. The monthly averages of these measurements are:

Month	Depth of water table (in.)	Month	Depth of water table (in.)
January	17	July	9
February	16	August	8
March	14	September	11
April	14	October	11
May	12	November	12
June	11	December	16

The figures show that with this drainage system the surface layer of the peat was not waterlogged in winter and was not far above the water table in summer.

EFFECT OF LIMING AND CULTIVATION

In a number of earlier trials on the Rukuhia swamp the effect of working lime into the peat was studied. These showed that working it in to a depth of 10 in. gave much better results than discing in the same quantity to 4 or 5 in. A similar trial was begun in 1957 on a farm near Taupiri on which the pasture on the peat was very poor. There was some growth from autumn until summer, when rainfall was sufficient, but in dry periods the surface layers of peat dried out and the pasture died.

The object of this trial was to reduce the acidity of the deeper layers of peat by working in lime. The effects of deep and shallow cultivation, each with four rates of lime (2, 4, 6, and 8 tons per acre), were studied. Half of the lime was applied before cultivation began and was worked into the peat by ploughing or discing, and the other half was applied to the surface after cultivation. On one portion the lime was worked in by ploughing to a depth of about 12 in. and the other portion was disced to 4 or 5 in.

The whole area was sown with pasture.

The pasture came up evenly, but pronounced differences due to the two methods of cultivation soon became apparent. Where the raw peat was brought to the surface by deep ploughing, the young pasture was nitrogen deficient and very weak during the first winter and spring. However, it grew vigorously during the summer and the hard-grazed pasture in winter provided a dense cover. This early and temporary setback was compensated for by the much improved pasture later.

On the disced area the pasture deteriorated as soon as the top layer of peat dried out in summer, and was open and weedy during the second winter. The differences between the two areas were even more marked in the second summer, when the pasture on the disced area deteriorated further and became still more weedy. These differences in the pasture were the result of the effects of the liming and cultivation on the acidity of the peat below 4 in. Results of analyses of soil samples taken three months after applying the lime showed that the average pH of the 4 to 8 in. layer on the ploughed area was 4.5 compared with 3.9 on the disced portion. When the lime was disced in the pH was not raised sufficiently to enable the pasture plant roots to penetrate below 4 in. This explains why the pasture on the disced area dried out so badly in summer.

On each of the two types of cultivation the pasture yields varied with the rates of lime. The yields were better where heavier rates of lime had been applied, but the differences were small.

It is not usual for raw peat to be as acid as that on which this trial was conducted and therefore lower rates of lime may be sufficient in other places.

RECOMMENDATIONS

The following recommendations are made for sowing down pastures on acid peat soils:

- Before cultivation, apply lime at 1 or 2 tons per acre, depending on the acidity of the peat. Two tons per acre are advisable where the pH is below 4. Less may be applied when the pH is higher.
- Cultivation should be to a minimum depth of 9 in. A swamp plough working to a depth of 12 in. has given excellent results.
- Apply more lime after cultivation. The lime applied at this stage should be sufficient to raise the pH of the 0 to 4 in. layer to about 5.
- A dressing of 3 cwt of copperised superphosphate and 1 cwt of muriate of potash per acre should be applied before seeding, and a similar dressing should be applied in the following spring.
- The aim of drainage should be to remove surplus water without affecting the water table below 18 in. Small drains 18 in. deep and spaced 2 chains apart are very efficient.

—*F. C. C. HUPKENS VAN DER ELST,*
Scientific Officer, Department of Agriculture Rukuhia Soil Research Station, Hamilton

What do we Know about FACIAL ECZEMA NOW?

By J. F. FILMER,
formerly Director, Animal Research Division, Department of Agriculture, Wellington

THE discovery in 1958 that facial eczema is caused by a fungus aroused much interest among both scientists and farmers. Scientists hailed the discovery as a major step toward solving a complex and difficult problem; farmers hoped that the new knowledge would result in the rapid development of better control methods. It would appear opportune to review progress made since the fungus was incriminated.

A NUMBER of different strains of the fungus (now known as *Pithomyces chartarum*) have been grown in the laboratory. While there is considerable variation in the behaviour of different strains in the laboratory, there is little or no evidence yet that the strains differ in their ability to produce facial eczema in the field.

"Sporidesmin" Studies

The ability to grow toxic fungi in the laboratory has greatly facilitated the work of the chemists. The liver damaging substance has been isolated and named "sporidesmin". It is being intensively studied to obtain a fuller understanding of its chemical structure and reactions.

A chemical test has been devised which measures the concentration of sporidesmin in culture material with considerable accuracy. Unfortunately it cannot yet be used for assaying the toxicity of spore contaminated pasture.

Sporidesmin occurs in the spores, in the actively growing parts of the fungus, and is also found in the culture fluid in which the fungus is growing.

The beaker test substance which was often found in toxic pasture is found mainly in the spores. Photographs of spores with the electron microscope suggest that it occurs on the outside of the spores, from which it can be washed with ether.

Two very delicate biological tests for sporidesmin have been devised. Artificially cultured cells known as HeLa cells are destroyed by very dilute solutions of sporidesmin. When such solutions are applied to the surface of a rabbit's eye they cause intense inflammation. Both of these tests can be performed with very small quantities of sporidesmin and take very much less time than was needed for guinea pig feeding tests.

Study of Liver Damage

Cultures of the fungus and culture extracts containing high concentrations of sporidesmin have been administered to guinea pigs and rabbits. These experiments have led to a better understanding of the way in which liver damage is produced. Feeding tests with pure sporidesmin to both laboratory animals and lambs have begun. These tests should determine whether sporidesmin alone is responsible for the liver damage in facial eczema.

Fungus and Spores

Studies in both the laboratory and the field have indicated that rapid fungal growth and spore production depend on the availability of suitable material on which the fungus will grow, high temperature, and moisture.

In the field the fungus grows on pasture litter, on damaged leaves, and on the surfaces of living plants in the presence of leaf exudates. When these spores are released from the growing fungus they become attached to the leaves of pasture plants.

As sheep seldom eat litter, it is likely that these spores rather than the fungus growing on the litter are responsible for the production of liver damage. This idea is supported by the correlation between spore counts and the degree of liver damage in lambs grazing the area on which the counts were made.

A machine has been devised which sucks up the spores and deposits them on a glass slide where they can be counted under a microscope. These spore traps will be used next autumn in a number of districts with a view to estimating their value for forecasting danger periods. It is not yet possible to determine how effective they will be, as counts can vary widely over small areas.

Anything which increases plant litter or damages plants during suitable weather will increase the spore count. Experimentally this can be done by mowing pasture and leaving the clippings on the ground or by severe harrowing.

Fungal growth varies widely on litter from different pasture plants. Growth is very profuse on litter of Yorkshire fog and ryegrass. On the other hand the fungus will not grow at all on sweet vernal litter. The fungus will grow on litter from white clover, but there is very little litter under the pure swards of vigorous white clover which have never produced liver damage in sheep grazing on them. In a rather limited number of observations no spores have been found on the litter from soft turnips.

The high temperatures (70 degrees F and over) and moist conditions required for rapid growth and spore formation occur after warm autumn rains. There is, however, still no reliable way of differentiating between the warm rains which induce facial eczema and those which do not, though there is now a suggestion that high maximum day temperatures may be of more importance than high minimum night temperatures.

Leaf exudates which stimulate fungal growth on growing plants are common in the young, flush growth of ryegrass after warm autumn rains. This may be why severe facial eczema outbreaks occur on such pasture after droughts, because there would not appear to be enough litter then to produce profuse fungal growth.

Fungicides as Control

Fungicides are so widely used for controlling fungal diseases of plants that their use for the control of facial eczema seemed a logical step. A number of fungicides were tested in the laboratory, where some of them proved very toxic to the fungus. However, in the field, even when applied repeatedly at weekly intervals, they did not prevent dangerous proliferation of the fungus.

It is possible that some new fungicide may prove effective, but the prospects do not appear very bright. To be effective it would have to be applied at the right time and would probably need to be repeated frequently. Such a procedure would be time consuming and expensive. Moreover, many fungicides are quite toxic to sheep.

Vaccination

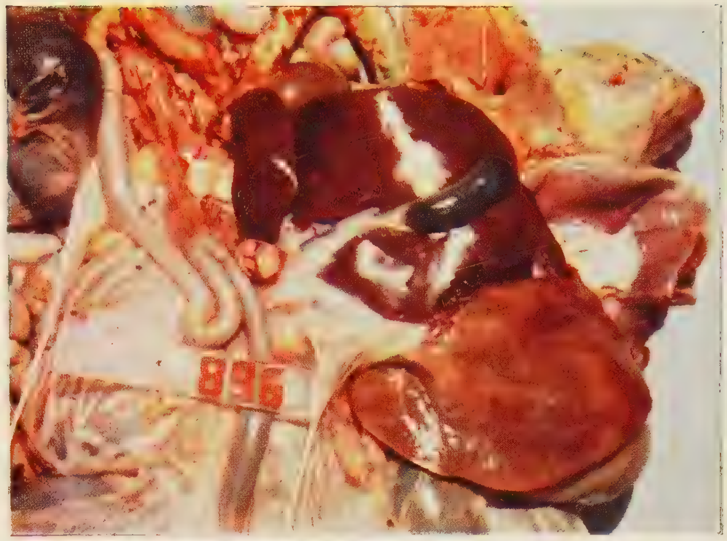
Vaccination has become a possibility since the discovery of the fungus, and its advantages are obvious. If stock could be adequately protected by vaccination in late summer, no other precaution would be necessary. Efforts are being made to produce a suitable vaccine, but it is too soon to do more than hope for success.

Pasture Management

Pasture management is the oldest control measure to be tried. In the disastrous outbreaks of 1938 it was observed that less trouble occurred on mature feed than on rapidly growing, CAUSE

Turf from Hamilton farm when fungus population was still very high. The fungus lives on the dead leaf matter woven through the lower levels of the grass.

EFFECT



Liver damage and jaundice in an experimental sheep in a facial eczema trial.

lush, ryegrass dominant swards which appeared when warm autumn rains followed a dry period.

Recently the effect on spore counts of grazing at various pasture levels has been studied. No clear picture has yet emerged. Future work may indicate significant interactions between pasture height and the growth and spore formation of the fungus. However, the grazing habits of sheep make it very difficult to maintain a uniformly long pasture, as once an area is eaten down they tend to concentrate on it and keep it short.

Irrigation

Because the fungus does not grow well in very wet conditions, it has been suggested that irrigation might be effective in preventing facial eczema. Field evidence is rather conflicting. On the one hand irrigation does on occasion appear to have prevented facial eczema. On the other hand serious liver damage has developed under very wet conditions. Experiments will be conducted this year to test the effect on fungal growth of irrigation of pasture at varying rates.

"Safe" Crops and Shutting up

As soon as it was shown in 1941 that pasture contained the liver damaging factor it became obvious that facial eczema could be prevented by ensuring that the consumption of toxic pasture was reduced to a minimum. The discovery of the fungus has not in any way invalidated this conclusion.

We now know that the liver damaging factor is in the spores adhering to the plant and probably not in the plant, but the sheep still eat the liver damaging factor with the plant.

Consumption of appreciable quantities of the liver damaging factor can be prevented either by grazing on safe crops such as the brassicas (turnips, kale, rape, chou moellier) and pure white clover swards; or by shutting up sheep at the rate of 200 or more per acre and feeding on hay.

These procedures have proved quite effective in preventing facial eczema. However, they have not proved popular for several reasons. It has not been possible to determine the dangerous periods with any degree of accuracy. Taking precautions after all warm rains is effective, but all warm rains do not produce facial eczema, and there is still no sure way of differentiating between those which do and those which do not.

Moreover the shutting up procedure itself produces some problems. Unless very high-quality hay is available the method cannot be used with lambs without serious loss of condition. In some districts losses from salmonella can be serious in ewes.

Because of these difficulties few farmers take the precautions recommended by the Department of Agriculture. Many farmers with wide experience of facial eczema compromise. In conditions which appear to them very dangerous they shut up their ewes and turn lambs on to crops. When conditions appear less dangerous they turn sheep into paddocks which experience has taught them are relatively safe. Lambs are sent to the works immediately conditions appear dangerous. In general, these practices work fairly well, but there are occasional disastrous losses.

Effects of Liver Damage

It has long been known that the severity of liver damage and the rate at which it develops vary greatly. Sometimes liver damage is very mild and recovery complete, with little or no permanent damage. On the other hand severe liver damage, jaundice, and skin lesions can occur very rapidly and a large proportion of sheep may die within a few weeks.

At other times very severe liver damage may develop slowly in a large proportion of the flock with no skin lesions. Such sheep, after a period of ill thrift, may apparently recover and even fatten. The liver, however, remains permanently damaged and lambing or any other severe stress causes heavy losses. These variations are probably due to the amount of the liver damaging factor and the period over which it is consumed.

Now that toxic spores can be grown in large quantities it has become possible for varying quantities of spores containing known amounts of sporidesmin to be fed to lambs over varying periods. Experiments which have begun along these lines should give accurate knowledge of the way the liver reacts to graduated doses of spores over varying lengths of time. It is hoped that these experiments will show just how many spores a sheep can tolerate per day over varying periods without serious and permanent liver damage.

This knowledge and the ability to estimate the spores available on pasture may make it possible to give greater assistance to farmers in the management of their sheep in dangerous periods.

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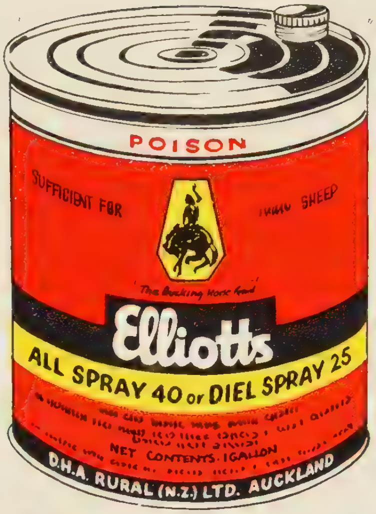
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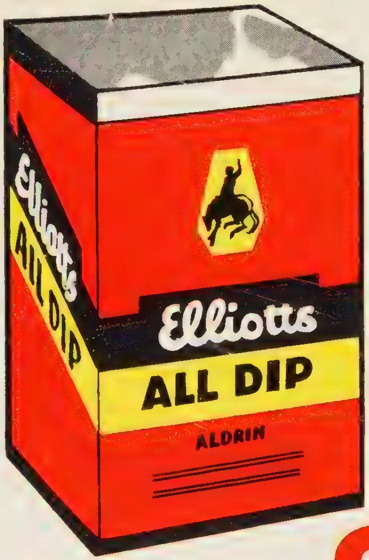
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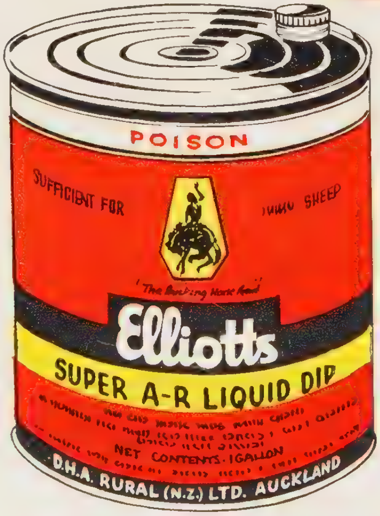
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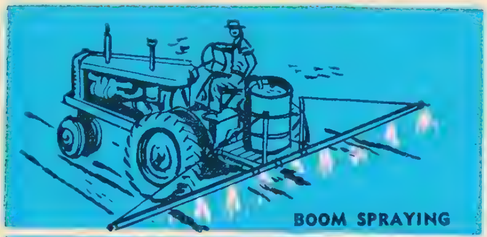

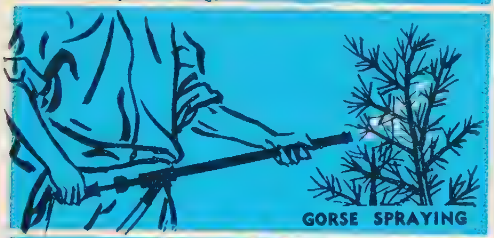

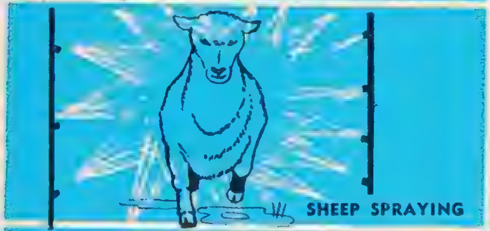

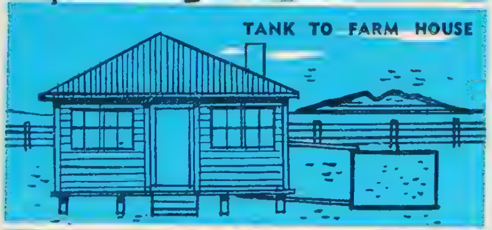

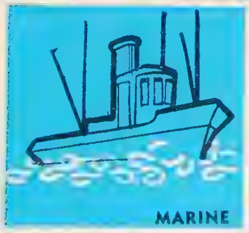

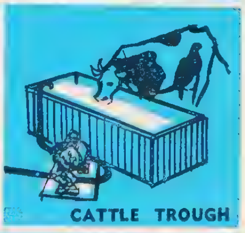

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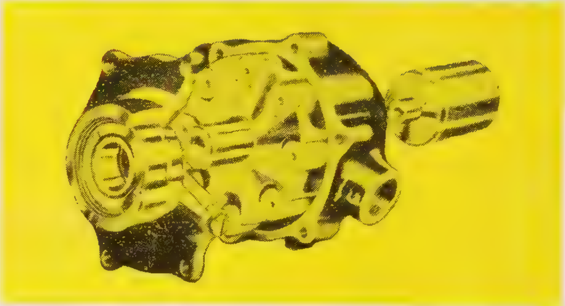

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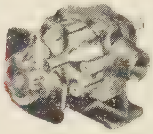

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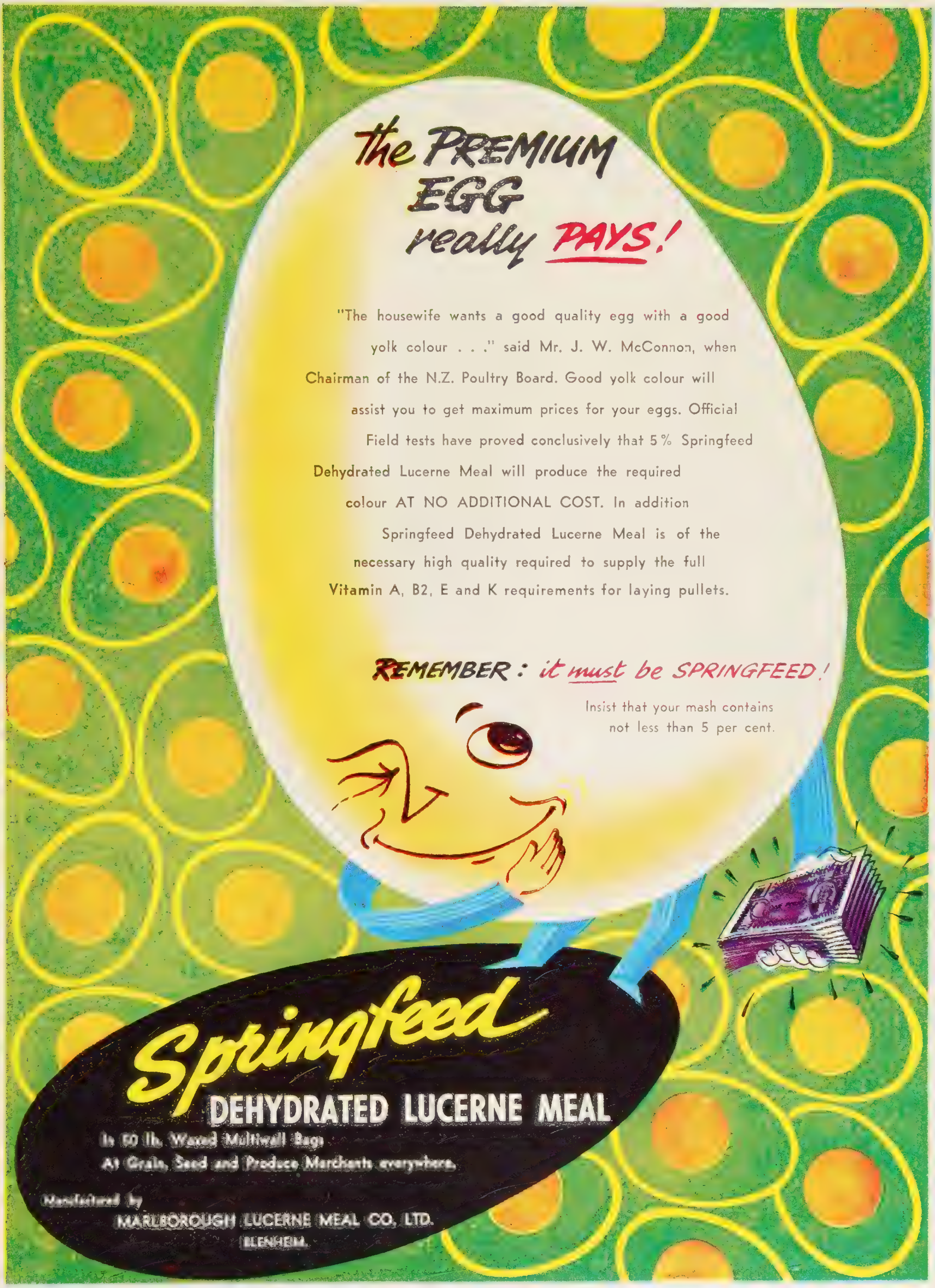

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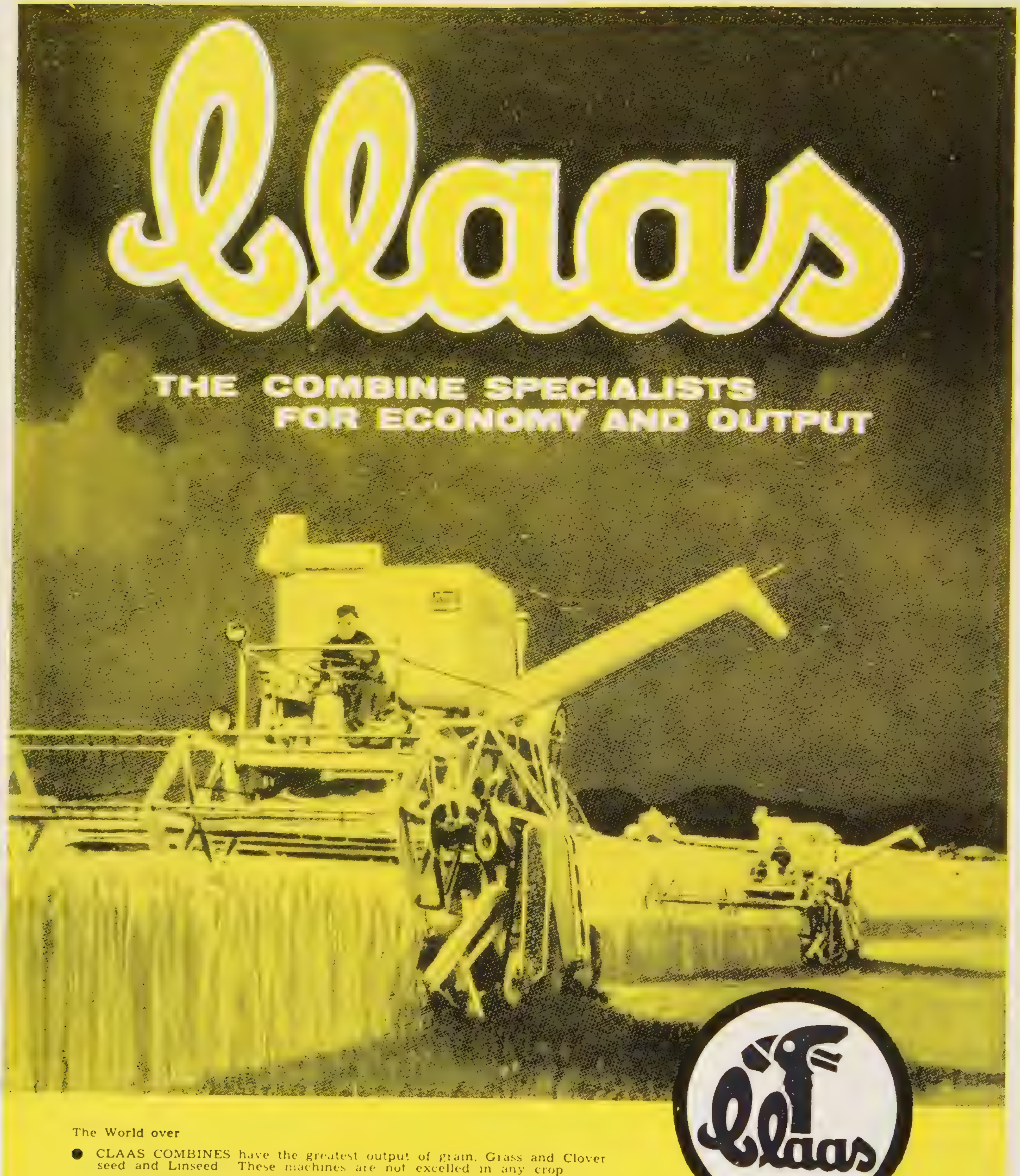

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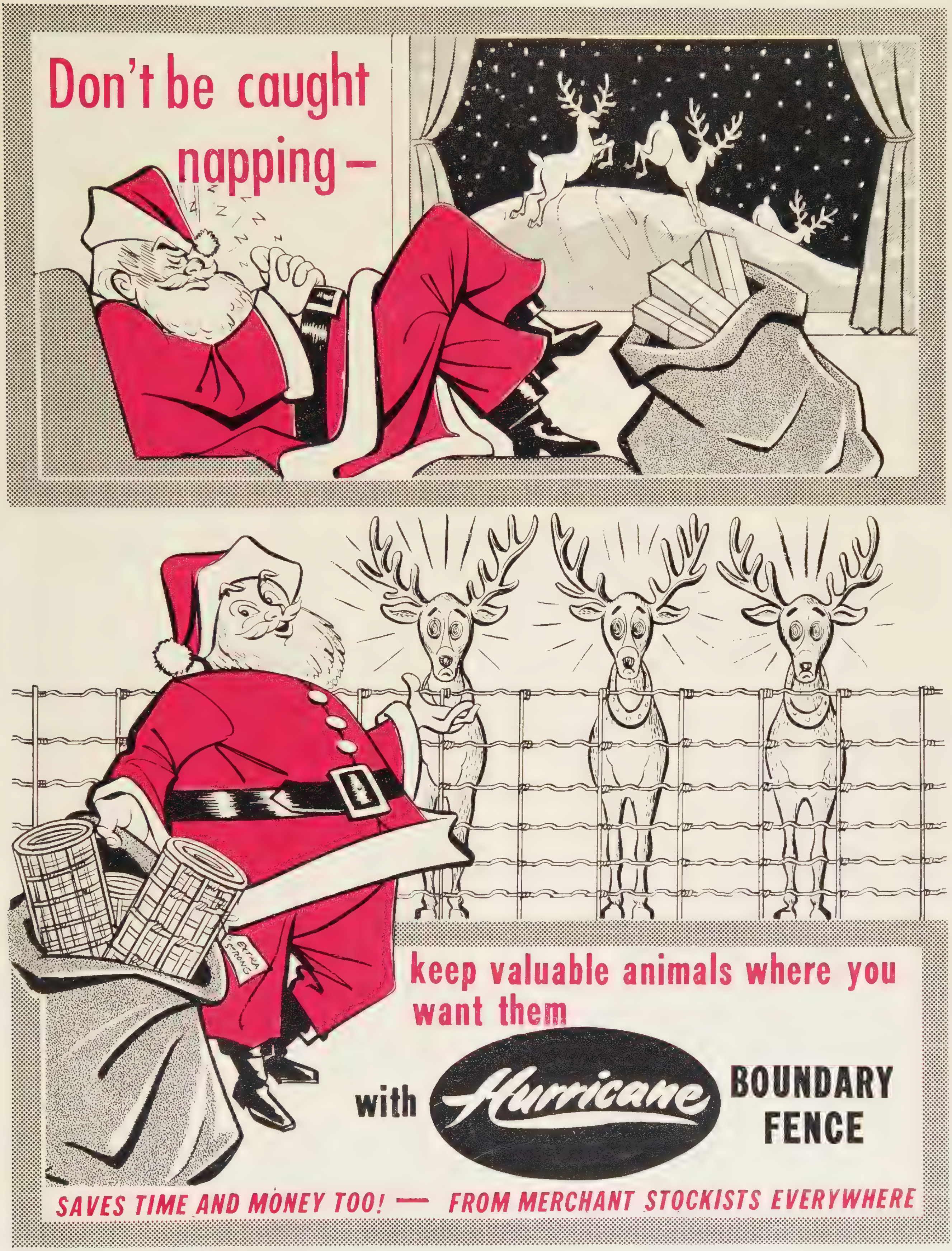

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Christmas Time

OUR midsummer Christmas in New Zealand brings its own special problems. Children have just started school holidays and on many farms shearing has just finished and harvesting is not far away. This means an exceptionally busy period for the homemaker, with Christmas shopping, Christmas cooking, and preparations for holiday picnics and excursions to be fitted into the busy days of midsummer.

CHRISTMAS is a joyous occasion—a time of family reunions, the exchange of gifts, and of feasting. Children are the centre of the family's gaiety, for this is a feast to celebrate the birth of the infant Christ. In this country the weather is usually hot and just before Christmas in most homes women are feverishly coping with shopping and with children newly released from school for the summer holidays.

Food plays an important part in our Christmas celebrations, and as Christmas Day draws near, our homes are filled with mouth-watering smells of freshly baked fruit cakes, mince pies, baked hams, and of biscuits being made to "fill the tins".

Even after a hundred years many New Zealanders still cling to the traditional Christmas food of England. Settlers from Europe and other lands have brought their customs and traditional Christmas fare and gradually our ways are changing. Fruit salad and ice cream often replace the traditional English plum pudding, which if it is included in the Christmas dinner, as often as not is served cold.

Boxing Day picnics at the beach or river mean that Mother must have prepared cold meats, pies, cakes, and biscuits, beside needing to have plentiful stocks of tomatoes, salad vegetables, and fresh fruit.

Christmas preparations can be a nightmare of rushed buying in crowded shops and cooking in a hot kitchen, with tired feet and a feeling of utter exhaustion the lot of the homemaker. Christmas Day with its fun and rejoicing may be spoilt for her.

Planning is Necessary

Sometimes our sense of values seems to be lost. Is it really necessary to rush about so feverishly? Would it matter if Christmas dinner were less elaborate than usual, especially if it meant that Mother were less tired and cross? If anyone looks forward to Christmas with dread because of the rush and load of work it brings, then the time has come for her to stop and think, "What is Christmas?"

It was once the time of a pagan festival. Is it still? It is supposed to be a family feast to celebrate the birth of a Baby. The greatest compliment a mother can pay her family is to be unruffled and happy with them on Christmas Day. This is by no means easy. Planning is needed to have everything prepared and wrapped on time. Planning is needed to spend an extra half hour with the children while they unwrap the presents that Father Christmas brought them, and still get everyone to Family Service on time. Planning is needed to cook

← Here is Tom's second-round hurdle. His wife kept as cool as the delicacies laid out before him by preparing them well in advance.

Above—After his afternoon nap Tom is ready for the last round, this late afternoon tea prepared by his grandchildren.

a midday Christmas dinner and not to present yourself at the table a hot and shining wreck instead of the calm, smiling mother you meant to be.

Prepare in Advance

Plan to shop for presents and Christmas decorations early in December or in November if possible. Rich fruit cakes mature in flavour and improve on keeping and so do plum puddings. These can be made as early as October and should be stored in airtight tins. By starting early, the cost of Christmas food can be spread over two or three months and this is a help to those who live on a tight budget.

Ice the cake 10 days or a fortnight before Christmas if a butter icing is preferred. Butter is affected by heat and the icing will develop an "off" flavour if it is kept too long in hot weather. Royal icing made with egg white will keep much longer than will butter icing, but is very hard and rather tasteless.

The plum pudding can be served chilled (put it in the refrigerator for an hour or so before dinner) with whipped cream or a cherry flavoured hard sauce.

Mincemeat also improves with keeping and if it is tightly packed into airtight containers and stored in a cool, dry place, it will keep for up to two years. Make the small mince pies a few days before Christmas and reheat them before they are brought to the table. The thought of more hot food on a hot day may appal some people, and though it is traditional to eat mince pies hot, there is no reason why they should not be eaten cold. They are made with puff pastry and should taste pleasant either hot or cold.

A late afternoon tea of Christmas cake, cold mince pies, and fresh, cool tomato and cucumber club sandwiches is as much as anyone would want on a hot summer afternoon and the main ingredients will have been prepared already. If the children are old enough, let them make the sandwiches and prepare the tea and so share the fun and some of the responsibility of "helping with Christmas".

Ham is the only meat which may be cooked and kept safely for some time before use, though it must be stored in a refrigerator. It will go bad rapidly if it is kept at summer air temperature, as much of the preserving brine is removed during cooking.

Frozen vegetables come into their own as time savers during the holidays, but it is not recommended that they be kept for more than a few days once they have been removed from the deep freezer. Always keep frozen foods in the freezer compartment of the refrigerator or in a freezer.

By BETTY JOHNSTON,
Home Science Instructor,
Department of Agriculture,
Wellington

Recipes

These recipes are for traditional English Christmas food and as well there are two well known New Zealand ones.

Turkey

Roast for 25 minutes per pound of stuffed weight of bird at 300 degrees F (electric) or regulator number 1 (gas).

Serve with sausage meat balls, chipolata sausages, or bacon rolls.

* * *

Turkey Stuffing

1 egg yolk
4 tablespoons of thick cream
1 tablespoon of chopped parsley
1 teaspoon of finely chopped tarragon
⅛ teaspoon of ground mace
Seasoning
10 oz of pork sausage meat
2 thin, lean bacon rashers, chopped
1 small onion, finely chopped
2 oz of fresh bread-crumbs
2 egg whites

Lightly beat the egg yolk and stir in the cream. Add the herbs and mix in the sausage meat, bacon, and onion. Stir in the breadcrumbs and add salt and pepper if necessary. (Ground black pepper is better than white.) Beat the egg whites until they are stiff and fold them into the mixture.

Pack the stuffing loosely into the bird (9½ to 10 lb) just before cooking. Do not stuff the turkey some hours before it is cooked, as it may begin to go "off".

* * *

Chestnut Stuffing

¾ lb of chestnuts
Sufficient water, giblet, or chicken stock to cover the skinned nuts
⅛ teaspoon of ground mace or nutmeg (less if preferred)
1½ oz of butter
1½ teaspoons of sugar
Pepper and salt to taste

Wash the chestnuts and boil them for about 15 minutes. When the nuts are cool enough to handle slit the skins and remove both the inner and outer skins. Put the nuts in a saucepan and cover them with the liquid. Bring to the boil, add the mace, and simmer for about 25 minutes until the nuts are soft or until most of the cooking liquid has been absorbed.

Rub the cooked nuts through a sieve or put twice through a finely meshed food mill. Stir in the butter, sugar, and seasoning and any of the remaining cooking liquid.

When the mixture is cold stuff the crop of the bird. For a 12 lb bird (dressed weight) 1 lb of chestnuts is required.

If there is any mixture left over, form it into balls, roll them in seasoned flour, then in beaten egg and crumbs. Grill or fry, and serve as a garnish.

* * *

Ham

Pre-soak the ham for six to 12 hours in cold water. Heat slowly to simmering point, then allow 25 to 30 minutes per pound of raw ham. If the ham is to be baked, omit the final hour of simmering.

Remove the ham from the hot water and cool it in a draught of cold air. Peel off the rind and some of the fat if necessary. Leave a good covering of fat (no pink flesh showing). Score the fat in diagonal lines. Press cloves into the fat, and rub or pat on a good coating of brown sugar.

Place the ham in a baking dish on aluminium foil (enough to enclose the ham completely). Fold the foil up round the sides and pour pineapple juice, cider, cheap white wine, or apple juice over the ham, making sure that none escapes from the foil. Complete wrapping the ham in the foil and bake it in a moderate oven for three-quarters to one hour depending on the size of the ham.

Remove the pan from the oven and open the foil so that the ham can

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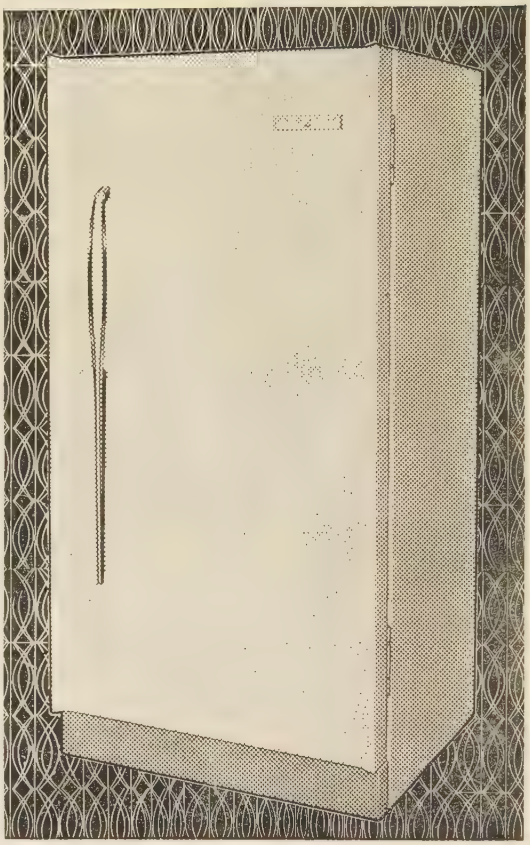

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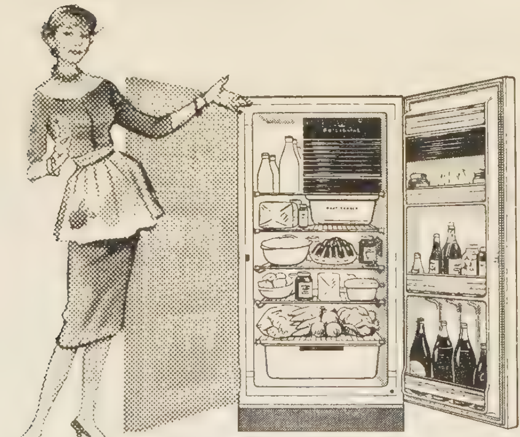

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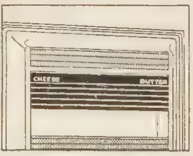

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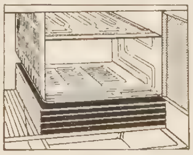

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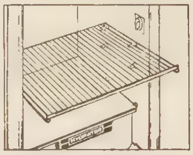

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cool with plenty of air round it. If it is to be kept in a refrigerator, rewrap it in the foil to prevent it from drying out.

Christmas Pudding

The flavour of Christmas puddings is enhanced with age. The puddings may be kept for one to two years before final cooking.

4 oz of prunes
½ lb of sultanas
½ lb of seedless raisins
4 oz of currants
4 oz of glace cherries, chopped
4 oz of mixed, chopped peel
2 oz of blanched almonds, chopped
2 oz of shredded carrot
2 eggs
2 teaspoons of pure glycerine
4 oz of flour
1 teaspoon of baking powder
½ teaspoon of salt
½ teaspoon of ground mace or nutmeg
1 teaspoon of cinnamon
1 teaspoon of mixed spice
6 oz of shredded suet
½ lb of fresh breadcrumbs
4 oz of brown sugar
4 tablespoons of lemon juice and grated lemon rind
4 to 6 tablespoons of brandy, rum, or whisky
2 tablespoons of golden syrup

Cook the prunes lightly, then drain, stone, and chop them. Wash and dry the sultanas, raisins, and currants and mix with the cherries, peel, and almonds. Add the prunes and mix thoroughly.

Mix the flour, baking powder, salt, and spices and sift into a large bowl. Chop in the suet and stir in the breadcrumbs, sugar, and carrot.

Beat the eggs together with the glycerine until the mixture is light, then stir in the dry ingredients. Add the lemon juice and rind and warmed golden syrup. Mix well. Blend in enough spirits to make a mixture that will drop easily from a spoon. Put in the prepared fruit and stir until the ingredients are blended. If threepenny bits are mixed in the pudding, wash them well in soapy water and boil them for 20 minutes before dropping them into the pudding mixture.

Divide the mixture between basins that have been well greased with butter and lined at the bottom with a circle of greased greaseproof paper. Do not fill the basins more than three-quarters full to allow space for the puddings to rise.

Cover each pudding with a layer of greased greaseproof paper and then cover with a double layer of ungreased greaseproof paper. Tie in position and make a handle with the string. If a cloth is used instead of a basin, scald it before use and flour it on the inner side. Aluminium pudding bowls with clip lids need only one layer of greaseproof paper under the lids.

Lower the puddings on to a wooden rack in a large pan or water bath. Fill the pan with enough water to come two-thirds of the way up the sides of the basins. Cover the pan and keep the water boiling throughout the cooking time, topping up with water when necessary. Allow seven to eight hours for puddings in two pint basins, six hours for one and a half pint basins and four to five hours for smaller puddings. Overcooking will not spoil the puddings.

If using a pressure cooker, cook in two and a half pints of boiling water or less if the water level is too high (four quart size cooker). Cover cooker and heat. Allow steam to flow from the vent pipe for 20 minutes before placing the indicator weight in position. Cook for 50 minutes at 10 lb pressure.

Before recooking on Christmas Day remove the covers and greaseproof paper and replace with fresh paper. Lower puddings into boiling water and boil for two to four hours or longer, according to size, or reheat in a pressure cooker for 20 minutes.

Cherry Butter

(Hard Sauce)

¼ lb of butter
¼ lb of icing sugar
¼ lb of castor sugar
2 to 3 tablespoons of cherry brandy
2 oz of glace cherries, chopped
Candied angelica

Cream the butter. Mix the sugars well and work them into the butter. Gradually stir in enough cherry brandy to make a thick, creamy mixture. Let it stand for about an hour and then stir in the cherries.

Chill the sauce before serving piled in a bowl and decorated with whole glace or maraschino cherries and angelica "leaves".

Use this hard sauce as a delicious accompaniment when the plum pudding is served chilled.

Christmas Cake

1 lb of butter
1 lb of brown sugar
10 eggs
2 tablespoons of golden syrup (warmed)
3 teaspoons of soluble cocoa
1¼ lb of sifted flour
1 teaspoon of salt
2 teaspoons of baking powder
½ packet of allspice
1 teaspoon of cinnamon
1 lb of seedless raisins
1 lb of currants
1 lb of sultanas
½ lb of chopped, stoned dates
¼ lb of glace cherries
½ lb of candied lemon peel
¼ lb of chopped, crystallised ginger
¼ to ½ lb of blanched almonds
1 medium tin of drained, crushed pineapple
2 to 4 oz of brandy or rum

Blanch the almonds, chop them roughly, and fry gently in butter. Wash the fruit and dry it in the sun or in a cool oven. Mix together the flour, spices, cocoa, salt, and baking powder as they are weighed. Grease a large cake tin and line the bottom with a double thickness of clean, greased brown paper and the sides with a double thickness of greased greaseproof paper. Preheat the oven to 300 degrees F.

Beat the eggs lightly. Cream the butter and sugar and add the beaten eggs a little at a time, mixing well. Blend in the warmed golden syrup. Sift some of the flour mixture over the fruit and stir it well. Stir the pineapple into the egg-sugar-butter mixture and gradually add the flour. Do not overstir the mixture. Put in the almonds and dried fruit, ginger, and peel, mixing gently but thoroughly.

Pour the cake batter into the cake tin and cook very slowly for five to six hours. The oven temperature may be reduced to 250 degrees F for the last hour and it may be necessary to cover the cake lightly with a layer of brown paper to prevent it burning on top.

Remove the cake from the oven and allow it to cool in the tin for quarter of an hour. Pour the brandy or rum over the warm cake. Leave the cake in its tin until it is almost cold and then finish cooling it on a rack. This will help to prevent its drying and will ensure that the maximum flavour is retained.

Store the cake in an airtight tin for one to two months before use.

Almond Icing

½ lb of ground almonds
1 lb of icing sugar
1 egg, beaten
1 egg white, well beaten
Plum or raspberry jam

Mix the almonds and icing sugar together. Add the beaten egg and sufficient egg white to make a stiff paste. Sift some icing sugar on the pastry board and roll out the paste to the required thickness. Brush the top of the cake with a light film of jam and press the almond icing on to it.

Cover the almond icing with royal icing (made with egg white), plastic icing, or butter icing. Butter icing will not keep particularly well in hot climates as the butter goes "off".

Use lemon juice with butter icing instead of water.

* * *

Mincemeat

½ lb of dried peaches
6 to 8 tablespoons of Kirsch (optional)
½ lb of seedless raisins
¼ lb of muscatel raisins
½ lb of currants
¾ lb of sultanas
2 lb of cooking apples
1 lemon (grate the rind)
1 teaspoon of honey
½ teaspoon of almond essence
¾ lb of stoned dates
4 oz of glace cherries
*4 oz of candied orange peel
4 oz of candied lemon peel
¾ lb of white or brown sugar
½ lb of shredded suet
1 teaspoon of salt
1 teaspoon of ground nutmeg
1 teaspoon of ground cinnamon

* Or increase lemon peel by 2 oz and use the juice of one orange.

This quantity is enough to fill seven 1 lb jam jars.

Do not soak the peaches. Cut them into small pieces (or mince). Sprinkle with three tablespoons of Kirsch. Wash the raisins, currants, and sultanas. Dry them in a slow oven and add half to the peaches.

Peel and core the apples. Chop half of them roughly and add to the peaches with all the grated lemon rind, juice, honey, and almond essence. Put the other half of the dried fruit and the dates, cherries, peel, and the rest of the apple through the mincer. Stir into the whole fruit. Sprinkle with the sugar, suet, salt, and spices and stir lightly. Add three to five tablespoons of Kirsch (enough to moisten thoroughly, but not to make a runny mixture) and stir well.

Pack the mincemeat into jam jars, pushing down firmly so that all air pockets are eliminated. Cover the jars with airtight tops.

Mincemeat will keep for two years if it is carefully packed in airtight jars to reduce evaporation and consequent drying out. If mincemeat does dry out, moisten it with sherry or brandy about a day before it is used.

* * *

Two New Zealand Recipes

Ice Cream

12 oz of milk
4 egg yolks
4 oz of sugar
Pinch of salt
1 teaspoon of vanilla essence
1 pint of cream

Make a soft custard with the egg yolks, milk, sugar, and salt. When the custard is cool add the vanilla essence. Whip the cream and fold it into the custard.

Pour the mixture into chilled freezer trays and place in the freezer compartment of a refrigerator which has been switched to very cold. (Remove any full milk bottles before switching the refrigerator down, as the bottles may crack if the milk freezes.)

The secret of making smooth ice-cream is to freeze the mixture as quickly as possible. Two freezer trays of this mixture should be ready to serve in 20 to 30 minutes. No stirring is necessary.

* * *

Pavlova Cake

6 egg whites
1 lb of castor sugar
2 teaspoons of white vinegar
1 teaspoon of vanilla
½ teaspoon of salt

Beat the egg whites to the foamy stage (approximately 50 turns of a hand beater).

Add the salt, vanilla, and vinegar and beat to the stiff foam stage (approximately 25 turns of the beater).

Add quarter of the sugar and beat about 25 turns. The mixture will be stiff.

Add quarter of the sugar. Repeat beating and adding sugar, ending with about 50 turns of the beater.

Pile on waxed or greased paper on an oven slide.

Cook for about one and a half hours at 250 to 275 degrees F. Watch for scorching. Turn off the oven after one hour if the cake appears to be scorching.

* * *

Care of Elastic Fabrics

MODERN research has disproved some long-held ideas, one of which was the belief that fabrics with a large proportion of rubber in them would deteriorate rapidly if washed frequently. Exactly the reverse applies to elastic garments in constant wear. The body oils and perspiration that come in contact with the rubber are harmful and garments that are subjected to them should be washed frequently, at least once a week. Two particular enemies of rubber are heat and oils of all kinds.

Elastic garments should be washed with pure soap or other mild detergent in warm to hand hot, never hot, water. Hand washing is preferable to machine washing. Any stubborn spots can be dealt with by a soft brush. Rinsing should be very thorough so that no traces of soap are left. Garments should be squeezed, never wrung; excess moisture can be removed by rolling in a towel. After this they should be pulled into shape and left to dry flat, away from direct heat or sunlight.

The pegging out of elastic fabrics on the line is not advised and they should not be ironed. No garment that has any elastic in it or on it (such as waistbands of undergarments) should be boiled; neither should they be put away unwashed. Swimsuits should be washed frequently and always after bathing in chlorinated water.

—M. B. STRAIN,
Home Science Instructor,
Department of Agriculture,
Dunedin

INDOOR PLANTS

By J. S. SAY,
Horticulturist,
Department of Agriculture,
Auckland

"HOW often should I water my pot plants?" Though this sounds a simple and reasonable question, it is well nigh impossible to answer except by saying "when they need it".

THOUGH faulty watering of indoor plants is probably the most frequent cause of death, it is only one of a number of inter-related factors which must be considered if pot plants are to be grown successfully. The others are light, humidity, air, temperature, potting compost, and container.

The sum of these is environment, which is very different from that of the plants in their natural habitats, which range from the hot, dry deserts of America to steamy tropical jungles.

To grow indoor plants well we should try to provide conditions somewhat resembling those of their natural homes or, conversely, select plants which will suit the environment where we intend to grow them.

It is not necessary to have an encyclopaedic knowledge of the origin of the plants to be successful with them, for most can be grouped fairly easily by their appearance and habit into various categories. Lists of plants suitable for particular positions and conditions are given on page 641.

Light

Light is necessary for all plants and is more often the limiting factor than is the water supply. While some plants need much more than others, many are tolerant of a wide range of light conditions. (Full details are given on page 641. Plants with soft stems and/or foliage (begonias, cyclamen, and primulas) in poor light have weak, elongated stems and pale foliage. Plants with coloured (not variegated) foliage (crotons, coleus) do not develop their full rich colour, and flowering plants such as tuberous begonias and cyclamen do not flower freely unless they have good light. Too much light causes hard, stunted growth and a bronzed, sunburnt appearance on plants which require reduced light.

Temperature

Temperature is less important in the cultivation of most indoor plants than is generally believed. An even temperature should be the aim. In general plants will stand quite low temperatures in winter if they are kept slightly on the dry side.

Plants which are normally grown in unheated rooms should not be brought into heated rooms "to keep them warm", but they should be moved away from windows on frosty nights.

In very cold districts low temperatures will limit the range of plants which can be grown unless the house is centrally heated.

High temperature with a dry atmosphere during the evening, followed by a sudden drop when the fire goes out, is harmful to most plants.

Temperature has a considerable effect on watering. In summer, growth is active and transpiration from the leaves and evaporation from pots and soil are rapid. In winter, high temperatures due to heating are usually accompanied by low humidity.

Humidity

Most plants prefer a high humidity, but in many homes and offices the air is too dry for good growth, especially where there is heating. Humidity can be increased about the plants by:

Standing the pots on moist sand, gravel, moss, peat, or sawdust in a shallow tray;

Plunging the pots in a damp material in a deeper trough;

Grouping a number of plants close together;

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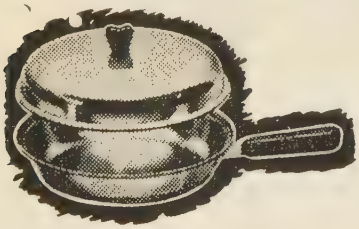

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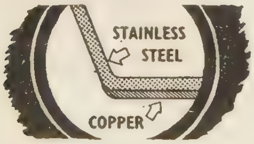

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Giving the plants a light spray of water with an atomiser.

To be of any great value spraying must be done frequently when humidity is low because of fires, space heaters, etc. While the air in heated rooms may be extremely dry, that in the kitchen and bathroom is often moist, making these rooms particularly suitable for some plants.

Air

All plants need fresh air, but they do not like draughts, which reduce humidity and are chilling. It is not necessary to open windows and doors to give them fresh air. Many plants are very susceptible to even slight traces of gas.

Potting Soil

Most indoor plants are happy in a normal potting mixture (see page 641) or in a mixture of more or less equal portions of peat and sand, which is being used by many nurseries today.

If they are fed regularly they will not need repotting for two years or more after purchase, unless they were very small plants in small pots, in which case they may need potting on to allow them to develop.

A 5 in. pot is large enough for the usual run of indoor plants, but very large plants need larger pots or even tubs. Plants should be kept in as small containers as possible, for an overpotted plant does not look well and as a rule does not do well. Once the plant is pot bound it must be fed and it will tend to dry out much more quickly.

The type of potting mixture has a considerable influence on the amount of water needed by plants and the frequency of watering and feeding. If they are in a mixture containing a large proportion of soil and organic matter, which tend to hold moisture and plant foods, they will need less frequent watering than if in a mixture of peat and sand. Plants which are in peat and sand must be fed before they become pot bound, for there is little food in that mixture, though it has the great advantage of being open and well drained and does not break down and pug as do mixtures consisting largely of soil.

Pots and Containers

Plastic pots and glazed pottery containers are satisfactory provided they have drainage holes. As there is no evaporation from these, they need far less water than the usual unglazed flower pot. For this reason it is very easy to over-water, which usually has more serious effects than under-watering.

Watering

In watering, the aim is to keep indoor plants nicely moist all the time; not too wet and not too dry.

No hard and fast rules can be laid down about the frequency of watering; it may be once a day or once a week, depending on the factors discussed above.

The best way is to check the plants **every** day. Even where there are quite a number of plants this takes only a few minutes at first and later, when experience is gained, a glance is usually enough to tell if individual plants need water.

Watering at regular intervals, say once or twice a week, is not good practice and watering only when the plants wilt is most harmful, as damage is done long before the plant actually collapses.

There are several ways of deciding if plants need water. Wilting is an indication of extreme dryness or too much water. When there is too much water the plants suffer because the roots rot and are unable to take up water.

The best way to check is to pick up the pot. If it feels light, the soil looks dry, and an unglazed flower pot feels dry, the plant needs water. If the pot feels heavy, the soil looks moist, and an unglazed flower pot feels cool and moist it does not need water.

Later, with experience, the feel of the soil and pot is usually sufficient

Protect Your Hands When Cutting *Euphorbia marginata*

Euphorbia marginata is becoming increasingly popular for floral decoration and as a commercial cut flower. As with other members of the *Euphorbia* family it has a milky sap which in quantity can cause skin irritation. The sap will also cause discomfort if it gets in the eyes.

Care should therefore be taken cutting flowers from these plants. In the garden it will be sufficient to rub a barrier cream on the hands, but commercial growers should wear rubber gloves, as well as applying barrier cream to the hands and arms, when gathering flowers or preparing bunches for market. Shirt sleeves should be rolled down and buttoned at the wrist or a long sleeved overall worn; this will protect the arms above the level of the gloves.

—J. P. SALINGER,
Horticultural Advisory Officer (Ornamentals), Department of Agriculture, Wellington

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and, once the plants are known, a quick look will generally indicate the need of water. If an unglazed flower pot is given a sharp tap, it will give a clear, bell-like note when dry and a dull note when wet. A pot which remains wet over a long period indicates that drainage is faulty and/or the soil mixture has broken down and has become puggy. The plant should be repotted.

The best and easiest way of watering plants is to pour the water in over the rim of the pot and let it soak through. The amount will vary from pot to pot, but sufficient should be given to allow some to soak through into the saucer or other container. The surplus water in the saucer should be thrown away as soon as it has ceased to drain through. If the pot is plunged in peat or moss, this will take up the surplus.

The soaking method is better if the soil is extremely dry and has left the sides of the pot. This is done by standing the pots to about half to three-quarter their depth in water and leaving them there until the water has soaked up to the surface. They should then be allowed to drain thoroughly.

This method, though it ensures that pots are thoroughly soaked, takes time and is not practicable if there are many pots and the rate of drying out varies. It is often adopted where plants are watered at regular set intervals. The result can be that some are not watered often enough while others are given too much.

Feeding

Feeding should be done regularly about every 10 to 14 days, except in the colder months when growth slows down. Complete, soluble fertilisers, sold under proprietary names as foliar fertilisers, are best. They should be applied to the soil as liquid feeds and not sprayed over the leaves.

POTTING MIXTURES

7 parts by volume of good garden soil
3 parts by volume of peat, leafmould, or compost
2 parts by volume of coarse river sand, fine scoria, gravel, or pumice
or
4 oz per bushel of general mixed fertiliser and 1 oz of garden lime
Equal parts by volume of shredded peat and fine sand
4 oz per bushel of general mixed fertiliser and 4 oz of garden lime

Repotting

Repotting and potting on into a larger pot should be done only when the plants are in need of it. Small plants may need to go into larger pots to develop, but after this repotting is needed only if the plant shows signs of deterioration in spite of regular care and attention or if the soil and drainage break down.

Plants are best repotted when they are coming into active growth. They should be knocked out of their pots and the old crocks removed. A good proportion of the old soil can be shaken from the roots or carefully scratched away with a stick. It is then usually possible to put the plant back into a pot the same size as the one from which it was taken, or one size larger. In this way it is possible to hold a large plant in a comparatively small container.

Plants for Particular Positions

Will Stand Full Sun

Most cacti and succulents, for example, aloe, cereus, echeveria, crassula, sedum, and kalanchoe. Two common exceptions are epiphyllum and zygocactus (schlumbergera).

Need Good Light for Best Growth

(North window screened by light curtain or blinds)

Cacti and succulents.

Flowering plants: Cyclamen, tuberous and other flowering begonias, primula, geranium, pelargonium, gloxinia, streptocarpus, saintpaulia, impatiens, anthurium.

Coloured foliage: Crotons, coleus, begonia, dracaena, philodendron, maranta, scindapsus.

Variegated foliage: Pisonia, peperomia, bougainvillea, abutilon, ficus, hedera (ivy), chlorophytum.

Best in Medium Light

(Screened east or west windows or interior of north-facing room)

Epiphyllum and zygocactus (schlumbergera).

Bromeliads (billbergia, nidularium, aechmea, cryptanthus.

Most plants with green foliage not mentioned under other headings.

Satisfactory in Medium Light

Foliage begonias, dracaena, dieffenbachia, pilea, chlorophytum, philodendron, scindapsus, variegated pisonia, peperomia, ficus, hedera.

Best in Poor Light

(Rooms receiving no direct sun)

Ferns, aspidistra, aglaonema.

Will Stand Poor Light

Palms, monstera, sansevieria, aralia, *Grevillea robusta*, *Araucaria excelsa*, brassaia, nothopanax, pseudopanax, pisonia, maranta, chlorophytum, ficus, philodendron, scindapsus, hedera, fatshedera, aucuba, dracaena, cordyline, meryta.

Will Stand Tough Conditions

(Neglect, dust, draught, but watch light and temperature)

Aglaonema, aspidistra, chlorophytum, dieffenbachia, dracaena, ficus, hedera, fatshedera, monstera, sansevieria, philodendrons (species with large green leaves), aralia, aucuba, brassaia, nothopanax, pseudopanax, cordyline, meryta, phormium.

Need Warmer Conditions than Can be Given by Most Homes in Cold Districts

Saintpaulia, anthurium, croton, caladium, calathea, dieffenbachia, coleus, iresine.

Will Stand Fluctuating and Low Temperatures

Aspidistra, hedera, fatshedera, palms, sansevieria, cordyline, phormium, pelargonium, ficus, aucuba, narcissus and hyacinths, asparagus, pseudopanax, nothopanax, myrtus (ramarama), nothofagus (red beech), dacrydium (rimu).

Garden Work for January

Gardens will need some extra attention after the holidays if they are to continue to look well during the summer. All faded flowers should be removed from bedding plants, shrubs, and herbaceous plants to encourage the production of further flushes of bloom later in the season. Old flowering stems of delphiniums, lupins, and similar plants must not be cut down to soil level, as this will weaken the plant. Cut back only as far as the topmost healthy leaves.

Rose Pruning

Complete the pruning of rambler and old shrub roses, cutting back to ground level or to a young lateral all stems which have flowered.

Floribunda roses should have the flower clusters removed, cutting back about half way to a healthy strong bud as soon as the petals drop.

Bush roses may be summer pruned in the middle of January and this is well worth while in the hotter parts of the country where flowering is usually poor from January to mid-March. New growth which has flowered should be pruned back to about four buds from the base. Any

By JOY WATKINS,
Horticultural Advisory Officer,
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Auckland

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very long new stems rising from ground level can be tipped; otherwise they can be left unpruned. It would be advisable to apply a fungicidal spray such as zineb at 1½ oz in 4 gallons of water or copper oxychloride at 3¼ oz in 4 gallons immediately after pruning to protect the wounds from disease. About four weeks after pruning apply a balanced fertiliser mixture at 4 oz to the square yard and water this in thoroughly. Flowering will begin again toward the end of March.

Manuring

During the growing season many plants appreciate a side dressing, though shrubs which come from the poorer soils of South Africa and Australia rarely need this treatment. Carnations, gerberas, and other herbaceous plants, fruit trees, and most deciduous trees and shrubs can safely be given a light dressing of blood and bone.

This should be applied to the soil round the plant to the approximate extent of its root system. The roots of shrubs and trees often extend about a yard beyond the drip line of the branches. The manure can be washed in with a hose or lightly hoed into the surface soil. Care should be taken not to disturb the roots. If the soil is dry, it should be watered thoroughly before any fertiliser is applied.

Lilies

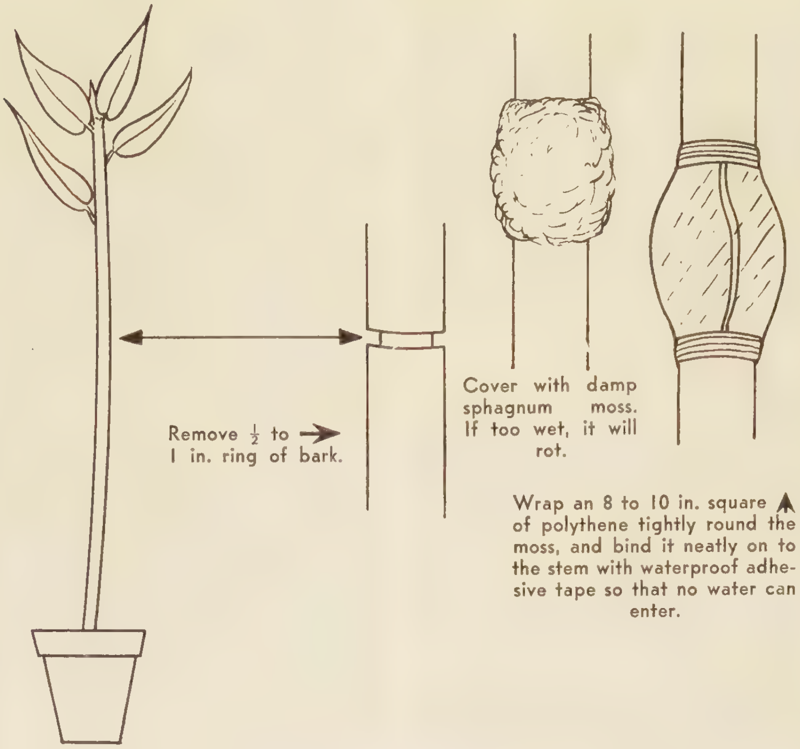
If it is desired to move lilies to another part of the garden, lift them carefully as soon as the flowers are fading. Moving at other times of the year can affect the flowering of the Madonna lily and many other European species which prefer to be left undisturbed.

A few scales can be removed from large bulbs and inserted in sandy soil in a frame or box. If desired, scales can be placed in damp peat, moss, or perlite in a plastic bag until the bulbils have formed, after which they can be transferred to a frame or nursery bed. Only healthy bulbs should be scaled. Those which have virus will transmit this disease to the offspring.

Another method of propagating those lilies which normally produce bulbils in the leaf axils is to wrench the flowering stem from the bulb and lay it in a shallow trench filled with sandy soil.

Species lilies will come true from seed, and this method is less likely to perpetuate virus disease. Seed should be sown as soon as ripe, as it quickly loses its viability. *L. monadelphum*, *L. szovitzianum*, and some North American species produce bulbils below ground and no growth above until the second spring. Therefore plantings in seedboxes or seedbeds should not be discarded after one year if the germination peculiarities of the lily are not known.

AERIAL LAYERING OF LEGGY HOUSE PLANTS



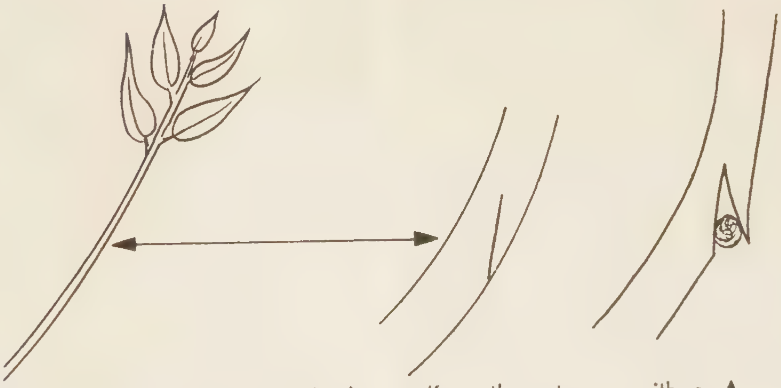
Remove ½ to → 1 in. ring of bark.

Cover with damp sphagnum moss. If too wet, it will rot.

Wrap an 8 to 10 in. square ↑ of polythene tightly round the moss, and bind it neatly on to the stem with waterproof adhesive tape so that no water can enter.

A good root system is formed in the moss within three months. Sever from the parent plant, pot up, and place in a cool, damp atmosphere until established.

AERIAL LAYERING OF SHRUBS



A 2 in.-long slanting cut is ↑ made up to the centre of the stem.

Keep the cut open with a ↑ piece of moss. Hormone preparations can be applied to the wound.

Cover with sphagnum moss and polythene as for house plants. Do not sever from the parent plant until the next winter, if deciduous, or early spring, if evergreen. Slow-rooting plants (azaleas and magnolias) should be left for two seasons before severing.

Shrub Cuttings

Cuttings can be taken from now on from the tips of shrubs. Soft tips 2 or 3 in. long, cut with a sharp knife just below a node and the lower leaves removed, can be placed in a jar of rain water with a piece of charcoal added to keep the water sweet. Such shrubs as hebe, hibiscus, and fuchsia root easily in this way. Alternatively they can be placed in a light porous soil mixture in a pot, watered in, and enclosed in a polythene bag to maintain a humid atmosphere. The cuttings should be shaded from direct sunlight, which will scorch them.

Planning

Gardens that have been planted largely with shrubs and bulbs which flower during the winter are not very attractive at this time of year. Note should be taken of any outstanding plants flourishing in conditions similar to one's own section.

Oleanders, campsis Mme. Galen, hydrangea, alstroemeria, hemerocallis, statice, peonies, bougainvillea, clerodendron, and lilies are a few which are full of colour now.

Foliage plants are of interest throughout the year and those with silver leaves generally flourish in hot, dry windy areas which are not suitable for other plants.

Shade

One well grown tree in the lawn is more effective than many different species planted so close together that none has sufficient room to grow and display its full beauty naturally. In large sections a group of three or five trees of the same species may be planted so that shade is cast between them. Such a group usually develops the outline of a single tree.

In a small section fruit trees provide welcome shade. The garden becomes more useful if the trees are in closely mown turf.

An enclosure close to the house provides shelter from the wind and pleasant conditions outdoors during summer. It may comprise a hedge, a tree and shrub border, or a wooden screen on which flowering climbing plants may be trained.

Planting can be of predominantly white flowers which look cool and tranquil on a hot day, particularly in the evenings. Scented plants might appeal to others.

A simple plan is the small courtyard or outdoor living area paved or mown, so that upkeep is at a minimum.

Plants in tubs can look attractive in a paved garden, but they will need frequent watering during summer, and usually a similar effect can be achieved by planting columnar (fastigiate) trees such as the Italian cypress or Irish yew or by training climbing plants up a strong post or other support.

The outdoor furniture may be of painted or oiled wood or metal, so that it can be left out. A permanent wooden seat, however simply constructed, placed in the shade of a tree at one end of this small "garden within a garden" can be a most attractive and restful feature. Most people like to sit down and enjoy the garden, if only for a few minutes in the day, but most gardens are without this amenity.

Cyclamen

Corms which have dried off during summer can now be potted and started into growth. Dead roots should be removed and any long, straggly roots cut back. A 5 in. pot should be well crocked to ensure good drainage, and then filled with John Innes compost. The upper half of the corm should be above soil level when potted, so that water will not get into the centre of the crown to rot it. Water and place in a warm humid atmosphere shaded from direct sunshine. Watch for aphids on the young leaves, as they can distort the leaves and flower buds by feeding on them when they are very small and soft. An ounce of lindane 25 per cent wettable powder or 1 oz of malathion in 4 gallons of water can be used to control aphids.

In summer cacti and succulent plants can be propagated from offsets, which should be pulled off and put into sand or perlite to root. Shallow, unglazed earthenware dishes, such as those used as saucers for large flowerpots, can be made into attractive cactus gardens. Crocks or scoria in the bottom provide drainage, and on this is placed good potting soil firmed down and covered with a layer of sand or perlite into which the unrooted portions of cacti and succulents are inserted. A year later, as the plants grow and need more room, some of them can be lifted and potted up.

Floral Decorations

When removing dead flower heads or cutting back early flowering plants, suitable seedheads should be left to ripen on the plant, so that they can later be cut and stored for winter decorations.

Some flowers may also be cut and dried. These should be picked when they are at their best for fresh arrangements, and dried in small bunches in a dark airy shed, after first removing all leaves. Darkness is essential if the colour is to be preserved. Many flowers other than the usual everlasting or straw flowers will dry satisfactorily and it is worth experimenting with flowers such as salvias, statice, delphinium, larkspur, yarrow, golden rod, and plume flower. An unusual everlasting flower which looks like red and white clover is *Gomphrena globosa*.

Book Review

"Horticultural Pests— Detection and Control"; G. Fox Wilson (Revised by P. Becker)

MOST books on pests and diseases tend to emphasise the cause of the trouble rather than effects on the host plant.

This book, on horticultural pests only, is written from the aspect of symptoms, of identifying the pest through the damage it causes.

This is particularly useful for the practical horticulturist, especially as the earlier chapters briefly describe the pests themselves. A wide range of control measures is also given, including up-to-date chemical materials.

The illustrations are carefully chosen to supplement the text and separate indexes list the pests and the plants.

Unfortunately for New Zealand readers, the book is written for English conditions, so that some pests discussed are not present here, while others we have are not described. However, the book would be of particular value if a local publication such as "Plant Protection in New Zealand" were used to supplement it.

—*J.P.S.*

Crosby Lockwood and Son Ltd. 25s. sterling.

Subscription Renewals

Renewals of subscriptions to "The New Zealand Journal of Agriculture" should be paid to the nearest office of the Department of Agriculture. Subscribers can ensure continuity of delivery by paying their subscriptions as soon as possible after receiving their renewal notices and at least one month before the old subscription expires. When payment is made the renewal notice should accompany the subscription to ensure that the correct details are recorded.

Be Careful with Insecticides

INSECTICIDES are widely used by housewives for getting rid of household pests such as ants, moths, silverfish, carpet beetles, and flies. They are sold in various forms: dusts, aerosols, residual sprays, and smoke bombs.

THESE insecticides have hazards in household use unless precautions are observed. Fumigants must be applied by a commercial pest-control operator.

Aerosols kill insects by direct contact, but have very little residual effect. Use for flies and mosquitoes.

A **residual spray** kills insects when they come in contact with the treated surface for varying periods after application. An invisible film of insecticide is left on the surface, killing insects that crawl or land on it. Use for carpet beetles, cockroaches, ants, and flies.

A **smoke bomb** gives off an insecticidal smoke when ignited and young larvae and adult insects are readily killed by exposure to this smoke, though many fully grown larvae are much more resistant. Use for carpet beetles, mosquitoes, weevils, fleas, and sandflies.

General Instructions for Using Insecticides

Read the instructions on the label carefully.

Do not inhale the insecticide.

Do not smoke or eat while using the spray.

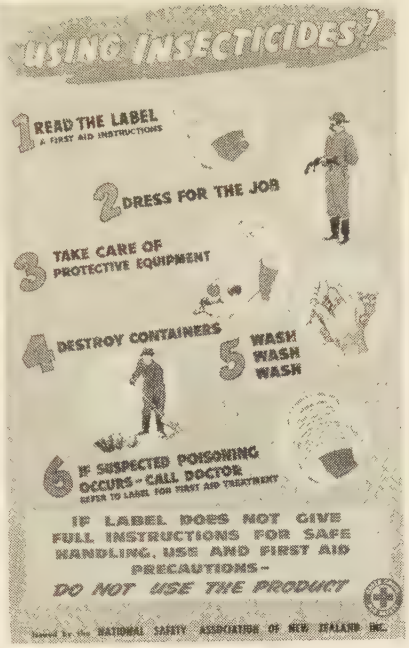
Do not contaminate food, dishes, utensils, or children's toys with the spray. Food should be well covered in airtight containers or removed from the room before spraying or dusting insecticides. Eating and cooking utensils should be well covered or thoroughly washed before being used.

If any insecticide is accidentally spilt on any part of the skin, wash it off immediately.

Any clothing on which it has been spilt should be removed as soon as possible.

Wait until the spray has dried or the dust or smoke has settled before uncovering cooking or eating utensils.

All working surfaces should be washed and the room thoroughly aired before using.


USING INSECTICIDES?
1 READ THE LABEL
& FIRST AID INSTRUCTIONS
2 DRESS FOR THE JOB
3 TAKE CARE OF PROTECTIVE EQUIPMENT
4 DESTROY CONTAINERS
5 WASH WASH WASH
6 IF SUSPECTED POISONING OCCURS – CALL DOCTOR
REFER TO LABEL FOR FIRST AID TREATMENT
IF LABEL DOES NOT GIVE FULL INSTRUCTIONS FOR SAFE HANDLING, USE AND FIRST AID PRECAUTIONS –
DO NOT USE THE PRODUCT
Issued by the NATIONAL SAFETY ASSOCIATION OF NEW ZEALAND INC.

Store the insecticide behind lock and key out of reach of children and pets.

Do **not** store it in a food cupboard.

Destroy empty containers, but do not throw them into fires or into incinerators, as they may burst.

If any of the insecticide is swallowed, call the doctor.

Read the label for first aid directions.

Additional Instructions for Using Aerosols

Keep windows and doors closed.

Do not direct aerosols on to surfaces of clothing, furniture, etc., but release the spray into free air.

Do not spray near an open flame.

Leave the room for 10 to 15 minutes as soon as you have finished spraying.

How to Use Residual Sprays on Carpets

Dilute the liquid as directed on the label.

With a coarse spray pump or the vacuum cleaner spraying attachment apply the insecticide to the edges of the carpets and underneath rugs and heavy furniture which are seldom moved. **This treatment must wet the carpet.**

Restrict the use of residual sprays to places where the pests are.

Wear gloves and hold the sprayer 6 to 12 in. from the surface to be treated.

Start spraying at a point furthest from the door. Do not spray wallpapers.

After spraying place pieces of cardboard under castors on furniture to prevent rusting.

Keep **windows open** when spraying.

Never use oil sprays where they could be ignited by an open flame.

You can use the room after one hour provided it has been **thoroughly aired.**

How to Use Smoke Bombs

Smoke bombs are easy to use without special equipment and the smoke finds its way into cracks, crevices, and confined spaces where insects may be hidden. Individual rooms in a house can be treated while adjacent rooms are occupied, provided any major exits in the room to be treated are sealed.

Calculate the capacity of the wardrobe, room, or building to be treated. You will then be able to decide on the size and number of smoke bombs to be used.

Smoke bombs should be placed on fire-resistant surfaces, for example, on a brick or in a bucket.

Windows, doors, and ventilators should be closed and the chimney blocked with sacking or paper.

As the smoke may slightly discolour some delicate fabrics, remove any rayon or silk furnishings from the room before treatment.

Ignite the bomb, close the room or building, and leave it for one hour. Then open all windows to air the room thoroughly before using it.

Fumigants

Some of the fumigants which are very effective can be applied only with the commercial equipment pest control operators have. However, there are on the market some fumigant type insecticides which are sold as being suitable for use in the home, but which can cause illness among the people living or working where they are used. These are the type in which a tablet or a liquid is vaporised by heat which may be generated by a special heater or by a special type of electric light bulb or an attachment to an electric light bulb.

Use of this equipment by those unfamiliar with it is most unwise.

—*JANET W. ROBERTS,*
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New Zealand Journal of Agriculture

Index to Volume 101, July-December 1960

July 1-104, August 105-216, September 217-320, October 321-432, November 433-544, December 545-648

A

Agricultural Research, 2.
Agricultural Talks, U.K. and N.Z., 497.
Allo, A. V.—
  Rotary Cutters and Weed Control, 273.
  Scotch Broom Controlled by Mowing after Poor Results from Spraying, 407.
  Transference of Fertility on Rolling Country, 571.
Aluminium Foil in the Kitchen, 537.
Animal Pests, 145.
Animal Quarantine, 322.
Animals, Farm, Tuberculosis of, 81.
Antibiotics, Care Needed in Injecting Pigs with, 256.
Anti-granulation Method for Honey Packers, 229.
Aphid Resistant Rape, 375, 486.
Apiary, Domestic, Spring Work in, 269.
Army Caterpillar, 557.
Artificial Breeding, 251.
Aucklander Short Top Potatoes, Virus Y-free, 133.

B

Banfield, G. L., Appointed Assistant Fields Superintendent, 117.
Banfield, G. L.—
  Army Caterpillar, 557.
  Studies in Farm Management: Coromandel Hill Country Farm, 474.
Banks, Naomi F.—
  Cheesy Tang Biscuits, 544.
  Crisp, Crisp Biscuits, 320.
  Electric Ranges, 313.
  Fabric Belt in Four Easy Steps, 312.
Banks Peninsula Demonstration Farm, 234.
Barley Grass, Control of, 119, 281.
Barrer, P. R., and Stuart, R. C.—Demonstration Farm on Banks Peninsula, 234.
Batten, G. J.—
  Maintaining Dairy Farm Races, 557.
  Newly Developed Scrub Land Needs Heavy Topdressing, 17.
Battens, Fence, Boron-treated, Farmers Warned not to Buy, 330.
Baylis, G. T. de S., death of, 129.
Beans, Growing of, 581.
Beans, Soya, Growing of, 280.
Beans, Using a Bumper Crop of, 583.
Bee Comb Foundation, Processed, 193.
Beef Bulls, Selection of, 281, 357.
Beef Cattle, Grass Staggers in, 559.
Beef Production, All Year Round, 115.
Beekeeping, Domestic, Notes, 269, 371, 471.
Beekeeping through 50 Years, 192.
Beet, Fodder, 273.
Bee-tight, Hives that are not, Moving, 355.
Belt, Fabric, in Four Easy Steps, 312.
Bennetts, R. L.—Topdressing and Oversowing Tussock Country, 35.
Biological Control of Insect and Weed Pests, 517.
Biscuits, Cheesy Tang, 544.
Biscuits, Crisp, 320.
Blacker, G. W. J.—Grafting Passionfruit Vines, 401.
Black Nightshade, 121.
"Black Seed" Disease of Strawberries, 576.
Bloat, Control of, by Spraying, 44.
Blowflies, Sheep, Dieldrin Resistance in, 329.
Bobby Calves, Skin Damage in, 7.
Bobby, F. C., and Edmondson, J.—Effect of Feeding Thiram-treated Wheat to Laying Birds, 447.
Bobby, F. C.—Poultry Industry, 1910-60, 169.
Book Reviews, 267, 381, 409, 425, 550, 570, 644.
Booth, A. K.—
  Pennisetum macrourum, 357.
  Preparing Hill Country for Oversowing, 563.
Boron for Swedes, 505.
Boron-treated Fence Battens, Farmers Warned Not to Buy, 330.
Bostock, Gwynneth V.—Neat Waistband on Skirt in Bulky Material, 536.
Boyce, W. R., and Webster, A. B.—Home-made Liquid Feeds for Trickle-irrigated Glasshouse Tomatoes, 607.
Boyer, M. G.—
  Build Silage Stacks with Sufficient Width, 353.
  Pasture Topping, 505.
Brash, A. G., Appointed Livestock Superintendent, 414.
Brassica Crops for Winter Feed, 505.
Brassica Crops, Young, Preventing Weevil Damage in, 557.
Brassicas, Reducing Dry Rot of, 47.
Breeding, Artificial, 251.
Brewers' Grains, Feeding, 249.
Broom, Scotch, Control of, 407.
Buddle, M. B., Redesignated Director, 561.
Bulls, Beef, Selection of, 281, 357.
Burgess, A. C.—Carrot Production, 613.
Burnell, R. E., and Johnston, A. A.—Skin Damage in Bobby Calves, 7.
Bush Sickness, Conquest of, 63.
Business Side of Farming:
  The Farmer and His Employees, 567.
  Use of Water from Natural Watercourses, 525.
Buttercup in Dairy Pastures, Control of, 143.
Butterfat per Acre, 274.
Buttermilk, Calves Profitably Reared on, on Taranaki Sheep Farm, 31.
Butter, New Zealand, United Kingdom Market for, 347.

C

Cage Paralysis, 114.
Caldwell, D. W., Appointed Chief Advisory Officer (Animal Health), 117.
Calves, Bobby, Skin Damage in, 7.
Calves Profitably Reared on Buttermilk on Taranaki Sheep Farm, 31.
Canterbury, Production of Winter Green Feed Cereals and Renovation of Dairy Pastures in, by Autumn Overdrilling, 21.
Canterbury, South, Rate-of-seeding Wheat Trials in, 126.
Carrots for Stock Feeding, 613.
Casey, R. J., and Yen, D. E.—Wilt-resistant Onward Peas, 565.
Cattle and Sheep, Redwater in, 517.
Cattle, Beef, Grass Staggers in, 559.
Cattle Ticks, Control of, with DDT Superphosphate, 331.
Cattle, Wrinkly Skin Disease of, 45.
Celery Varieties Treated with Gibberellic Acid, 575.
Cereals, Chemical Weed Control in, 273.
Cereals, Spring-sown, 143.
Cereals, Winter Green Feed, Production of, and Renovation of Dairy Pastures in Canterbury by Autumn Overdrilling, 21.
Chambers, G.—Feeding Brewers' Grains, 249.
Chambers, R. G.—Lambing Device, 86.
Chemical Control of Weeds in Animal Crops, 405.
Chemical Weed Control in Cereals, 273.
Chisel Plough, 411.
Christie, C. J.—Nitrogen for Grass Seed Crops, 47.
Christmas Recipes, 632.
Clarke, E. A.—Fern Control, 449.
Clover Seed, Inoculation and Pelleting of, 619.
Comb Foundation, Bee, Processed, 193.
Composts, Seed and Potting, New Types of, 120.
Contagious Abortion, 33, 119, 253, 291, 356, 442, 504, 507, 517.
Copper Deficiency, 71.
Coromandel Hill Country Farm, 474.
Coughlan, A. J.—Lucerne Stands, 505.
Couston, Eleanor—Measures in Cooking, 203.
Cover Crops, Effect of, on Pasture Establishment, 115.
Cowen, S. J., Appointed Superintendent of Market Milk, 336.
Crop Production: Carrots, 613.
Crops, Annual, Chemical Control of Weeds in, 405.
Crops, Brassica, for Winter Feed, 505.
Crops, Controlling Springtails on, 266.
Crops, Overwatering Can Damage, 503.
Crops, Winter Feed, for Pigs, 143.
Cross, M. W.—Chisel Plough, 411.
Cullen, N. A.—Lucerne-grass Mixtures, 526.
Curd, Preserving Surplus Skim Milk as, for Pig Feeding, 89.
Currie, J. D., and Doutre, J. L.—Hill Country Spray Plant, 443.

D

Dairy, Farm, Milk Cooling at, 385.
Dairy Farm Races, Maintenance of, 557.
Dairy Herd, Winter Management of, 44.
Dairy Industry, 1910-1960, 48.
Dairy Pastures, Control of Buttercup in, 143.
Dairy Pastures, Renovation of, and Production of Winter Green Feed Cereals in Canterbury by Autumn Overdrilling, 21.
Dairy Produce Graded for Export during May, 134; during June, 266; during July, 414; during August, 458; during September, 612.
Dairy Water Heater, Buying a, 592.
Dam, Farm, Constructing a, 346.
"Damp-off" Disease, Fungicidal Treatment of Lucerne Seed to Control, 45.
Davies, D. J. G.—Production of Winter Green Feed Cereals and Renovation of Dairy Pastures in Canterbury by Autumn Overdrilling, 21.
DDT Superphosphate, Control of Cattle Ticks with, 331.
Deer, War on, 159.
Delahunty, E.—Weevil Damage in Young Brassica Crops, 557.
de Lautour, Patricia M.—Milk in Diet, 426.
Dieldrin Resistance in Sheep Blowflies, 329.
Disease, Control of, by Vaccination, 72.
Dog Chain, Handy, 570.
Domestic Beekeeping Notes, 269, 371, 471.
Doutre, J. L., and Currie, J. D.—Hill Country Spray Plant, 443.
Doutre, J. L.—
  Better Silage Facilities, 143.
  Constructing a Farm Dam, 346.
Drainage, Mole, 271.
Drake, A. D., and Hastings, A.—Inoculation and Pelleting of Clover Seed, 619.
Drake, C., Hartley, W. J., and Grant, A. B.—Control of White Muscle Disease and Ill Thrift with Selenium, 343.
Drenching Gun Injury, Mortality in Lambs after, 115.
Drill, Jack for, 141.
Driver, C. M.—Tahi and Rua Potatoes, 218.
Dry Rot of Brassicas, Reducing, 47.
Duncan, A. A.—
  A Waimarino Fat Lamb Farm, 593.
  Improvement of Hill Country Pastures, 93.
During, C.—Lime Transport Assistance, 335.

E

Earmarking Systems for Pigs, 485.
Economics, Farm, Review of, 83.
Edmondson, J., and Bobby, F. C.—Effect of Feeding Thiram-treated Wheat to Laying Birds, 447.
Edmondson, J., and Miller, Jean G.—Experiments to Develop Test for Poultry Feeds, 397.
Edwards, E. D.—Pig Housing, 551.
Elastic Fabrics, Care of, 636.
Electric Fences on Hill Country, 356.
Electric Ranges, 313.
Elements, Trace, Role of, in Nutrition of Grazing Animals, 489.
Euphorbia marginata, Protecting Hands against, 639.

F

Facial Eczema, 624.
Facial Eczema Fungus, 486.
FAO Freedom-from-hunger Campaign, 508.
Farm Dairy, Milk Cooling at, 385.
Farm Economics, Review of, 83.
Farmer, The, and His Employees, 567.
Farming, Business Side of, 525.
Farrowing House for Larger Piggery, 197.
Feed Crops, Winter, for Pigs, 143.
Feeding Brewers' Grains, 249.
Feeding off Grain Residues, Dangers in, 281.
Feeding the World's Millions, 508.
Feeds, Poultry, Experiments to Develop Test for, 397.
Feed, Summer, Turnips for, 353.
Feed, Supplementary, with Skim Milk in Pig Feeding, 87.
Fence Battens, Boron-treated, Farmers Warned Not to Buy, 330.
Fences, Electric, on Hill Country, 356.
Fern Control, 449.
Ferrier, Judith—
  Aluminium Foil in the Kitchen, 537.
  Decorative Table Mats, 432.
Fertilisers, Phosphatic, Residual Value of, 280.
Fertilisers, Potassium, Comparison of, 604.
Fertility, Transference of, on Rolling Country, 571.
Filmer, J. F.—
  Agricultural Research, 2.
  Butterfat per Acre, 274.
  Facial Eczema, 624.
  Role of Trace Elements in Nutrition of Grazing Animals, 489.
  Vaccination, 389.
Filmer, J. F., Retirement of, 109, 487.
Film, Ruakura, "Good Shepherding", 110.

Flower Garden Notes, 94, 211, 301, 415, 527, 637.
Flowers, Old Fashioned, 301.
Focal Point of Rooms, 320.
Fodder Beet, 273.
Foil, Aluminium, in the Kitchen, 537.
Foliage for Effect in Flower Garden, 415.
Forbes, I. G.—
    Developments in Growing Glasshouse Tomatoes, 459.
    Outdoor Tomato Varieties, 361.
Frew, S.—
    Home Orchard in Spring, 135.
    Home Orchard in Summer, 519.
Fungicidal Treatment of Lucerne Seed to Control "Damp-off" Disease, 45.
Fungus, Facial Eczema, Sporing of, Field Survey on, 486.
Furniture, Wrought Iron, 536.

G
Gabites, J. F.—Planning Irrigation Needs of Land, 440.
Gallagher, R. M.—Selecting a Beef Bull, 357.
Garden, Flower, Notes, 94, 211, 301, 415, 527, 637.
Garden, Home and Market, Notes, 257, 581.
Garden, Home, Notes, 37, 592.
Gardening, Market, through 50 Years, 189.
Gibberellic Acid, Celery Varieties Treated with, 575.
Glasshouse for Flower Garden, 94.
Glasshouses, Tomato, Soil Sampling in, 329.
Glasshouse Tomatoes, Developments in Growing, 459.
Glasshouse Tomatoes, Leaf Mould Disease in, 363.
Glasshouse Tomatoes, Trickle-irrigated, Home-made Liquid Feeds for, 607.
Goodall, R. W.—Turnips for Summer Feed, 353.
Government Approved Turnip and Swede Seeds, 356.
Grafting Passionfruit Vines, 401.
Graham, J. A.—Summer Pasture Management, 505.
Grainger, A. R., Retirement of, 117.
Grain Residues, Dangers in Feeding off, 281.
Grant, A. B., Hartley, W. J., and Drake, C.—Control of White Muscle Disease and Ill Thrift with Selenium, 343.
Grass and Clover Seeds, Harvesting, 557.
Grass-lucerne Mixtures, 526.
Grass Seed Crops, Nitrogen for, 47.
Grass Staggers in Beef Cattle, 559.
Grazing Animals, Role of Trace Elements in Nutrition of, 489.
Greaves, N. H.—Care of Seed Potatoes, 47.
Green Feed Cereals, Production of Winter, and Renovation of Dairy Pastures in Canterbury by Autumn Overdrilling, 21.
Gunning, B. A.—Boron for Swedes, 505.

H
Haddow, G. B.—Weed Control in Pastures, 47.
Harrowing in Pasture Management, 231.
Hartley, W. J., Grant, A. B., and Drake, C.—Control of White Muscle Disease and Ill Thrift with Selenium, 343.
Hastings, A., and Drake, A. D.—Inoculation and Pelleting of Clover Seed, 619.
Heater, Water, Dairy, Buying a, 592.
Herd, Dairy, Winter Management of, 44.
Hill Country, Electric Fences on, 356.
Hill Country Pastures, Improvement of, 93.
Hill Country, Preparing, for Oversowing, 563.
Hill Country Spray Plant, 443.
Hives, Domestic, Preparing, for Honey Flow, 471.
Hives that are Not Bee-tight, Moving, 355.
Hobbs, R. H.—Domestic Beekeeping Notes, 269, 371, 471.
Hoggets, Turnips as Winter Feed for, 577.
Home and Market Garden Notes, 130, 257, 361, 459, 581.
Home Garden Notes, 37, 592.
Home Orchard in Spring, 135.
Home Orchard in Summer, 519.
Honey Flow, Preparing Domestic Hives for, 471.
Honey Packers, Anti-granulation Method for, 229.
Hopkins, J. M.—Protecting Stored Silage from Weather, 356.
Hop Varieties Tolerant to Root Rot, Breeding, 605.
Horticultural Development, 1910-1960, 182.
Hudson, A. W.—Effect of Sulphur on Soil Acidity, 283.
Hupkens van der Elst, F. C. C.—Drainage, Cultivation, and Liming of Peat, 623.
Hydatids, Eradication of, 180.
Hydatid Testing Station Opened, 85.
Hyperkeratosis of Cattle, 45.
Hypomagnesaemia in Beef Cattle, 559.

I
Ilam Hardy Variety, Effect of Potato Virus Y on, 330.
Ill Thrift and White Muscle Disease, Control of, with Selenium, 343.
Ill Thrift, Animal, on Rotomahana "Mud" Country, 546.
Indoor Plants, 637.
Inoculation and Pelleting of Clover Seed, 619.
Insecticides, Be Careful with, 645.
Insect Pests, Biological Control of, 517.
Irrigation Needs of Land, Planning, 440.
Irrigation, Pasture, Seasonal Variations in, 388.
Isotopes, Radioactive, and Research, 329.

J
Jack for Drill or Topdresser, 141.
Jacobs, L., Studying Disease at Wallaceville, 6.
James, J. P.—Artificial Breeding, 251.
Janett, D. L.—
    Controlling Springtails on Crops, 266.
    Harrowing's Limited Role in Pasture Management, 231.
Johnston, A. A., and Burnell, R. E.—Skin Damage in Bobby Calves, 7.
Johnston, Betty—
    Christmas Recipes, 632.
    Using a Bumper Crop of Beans, 583.
Jones, J. H.—
    Processing and Marketing of Turkeys, 377.
    Turkey Breeding, 293.
Jubilee Supplement, 50th, 48, 145.

K
Kennelly, A. G.—
    Home Garden Notes, 37, 365, 469.
    Leaf Mould Disease in Glasshouse Tomatoes, 363.
    Vegetable Production: Rhubarb, 130.

L
Lamb Fattening with and without Ryegrass, 604.
Lambing Device, 86.
Lambs, Mortality in, after Drenching Gun Injury, 115.
Lambs, Selenium Responses in, 605.
Lambs, Weaned, Shearing, 369.
Lammerink, J.—Seasonal Variations in Pasture Irrigation, 388.
Land Development on West Coast, 434.
Land, Planning Irrigation Needs of, 440.
Lauder, B. A.—Overwatering Can Damage Crops, 503.
Laying Birds, Effect of Feeding Thiram-treated Wheat to, 447.
Leaf Mould Disease in Glasshouse Tomatoes, 363.
Lee, P. J., and Tenquist, J. D.—Animal Quarantine, 322.
Leonard, W. F.—Weed Control in Peas, 353.
Lime Transport Assistance, 335.
Line, L. J. S.—Moving Hives that Are Not Bee-tight, 355.
Litter, Sow and, Management of, 287.
Livestock, Care of, during August, 46; during September, 142; during October, 272; during November, 352; during December, 504; during January. 556.
Livestock Industry, 1910-1960, 63.
Livestock Numbers and Production in U.S.A., 111.
Logarithmic Sprayer, Weed Control Experiments with, 516.
Longwill, A.—
    Farrowing House for Larger Piggery, 197.
    Pig Husbandry through the "Journal", 161.
Lucas, P. H. C.—Land Development on West Coast, 434.
Lucerne-grass Mixtures, 526.
Lucerne in the Waikato, 114.
Lucerne Seed, Fungicidal Treatment of, to Control "Damp-off" Disease, 45.
Lucerne Stands, Maintenance of, 505.
Lucerne, Weed Control in, 141.

M
McCulloch, W. J., Death of, 336.
McFetridge, M. J.—Milk Cooling at Farm Dairy, 385.
McLeod, C. C.—
    Chemical Weed Control in Cereals, 273.
    Rate-of-seeding Wheat Trials in South Canterbury, 126.
McMeekan, C. P., Redesignated Director, 561.
Magnesium in Pastures, 605.
Malayan Agricultural College, New, 346.
Maple Peas, New Grades for, 92.
Market and Home Garden Notes, 130, 257, 361, 459, 581.
Market Gardening through 50 Years, 189.
Market Milk Industry, Review of, 57.
Mastitis, Control of, 75.
Mats, Table, Decorative, 432.
Matthews, L. J.—Weed Identification and Control:
    Black Nightshade, 121.
    St John's Wort, 19.
Measures in Cooking, 203.
Merry, D. M. E.—
    Chemical Control of Weeds in Annual Crops, 405.
    Control of Barley Grass, 119.
Meteorological Records for April, 35; for May, 35; for June, 134; for July, 266; for August, 334; for September, 473; for October, 580.
Milk Cooling at Farm Dairy, 385.
Milk in Diet, Value of, 426.
Milking Management, 221.
Milking Sheds, 1910-1960, 59.
Miller, J. A. S.—Effect of Potato Virus Y on Ilam Hardy Variety, 330.
Miller, Jean G., and Edmondson, J.—Experiments to Develop Test for Poultry Feeds, 397.
Milne, R. A.—Weed Control in Lucerne, 141.
Mole Drainage, 271.
Muller, F. B.—Control of Cattle Ticks with DDT Superphosphate, 331.
Murdoch, A. R., and Turnbull, H. G.—Calves Profitably Reared on Buttermilk on Taranaki Sheep Farm, 31.

N
Nichols, M. A.—"Black Seed" Disease of Strawberries, 576.
Nitrogen for Grass Seed Crops, 47.
Nutrition of Grazing Animals, Role of Trace Elements in, 489.
Nutrition of Grazing Sheep, 9.

O
Opossums, War on, 157.
Orchard, Home, in Spring, 135.
Orchard, Home, in Summer, 519.
Overdrilling, Autumn, Production of Winter Green Feed Cereals and Renovation of Dairy Pastures in Canterbury by, 21.
Oversowing and Topdressing Tussock Country, 35.
Oversowing, Preparing Hill Country for, 563.
Overwatering Can Damage Crops, 503.
Owtram, I. H.—
    Earmarking Systems for Pigs, 485.
    Management of Sow and Litter, 287.
    Supplementary Feed with Skim Milk in Pig Feeding, 87.

P
Palmer, T. P.—Aphid Resistant Rape, 375, 486.
Passionfruit Vines, Grafting, 401.
Pasture Establishment, Effect of Cover Crops on, 115.
Pasture Irrigation, Seasonal Variations in, 388.
Pasture Management, Harrowing in, 231.
Pasture Management, Summer, 505.
Pastures, Dairy, Control of Buttercup in, 143.
Pastures, Dairy, Renovation of, and Production of Winter Green Feed Cereals in Canterbury by Autumn Overdrilling, 21.
Pastures, Hill Country, Improvement of, 93.
Pastures, Magnesium in, 605.
Pastures, Weed Control in, 47.
Pasture Topping, 505.
Peas, Maple, New Grades for, 92.
Peas, Weed Control in, 353.
Peas, Wilt Resistant Onward, 565.
Peat, Drainage, Cultivation, and Liming of, 623.
Pedigree Pig Improvement Scheme, 202.
Pennisetum macrourum, 337.
Pests, Insect and Weed, Biological Control of, 517.
Phillips, D. S. M.—Milking Management, 221.
Phosphate Topdressing, Residual Effect of, 329.
Phosphatic Fertilisers, Residual Value of, 280.
Pig Feeding, Supplementary Feed with Skim Milk in, 87.
Piggery, Larger, Farrowing House for, 197.
Pig Housing, 551.
Pig Husbandry through the "Journal", 161.
Pig, Pedigree, Improvement Scheme, 202.
Pigs, Care Needed in Injecting, with Antibiotics, 256.
Pigs, Earmarking Systems for Identifying, 485.
Pigs, Wild, War on, 155.
Pigs, Winter Feed Crops for, 143.
Plant Quarantine, 191.
Plants, Indoor, 637.
Plants, Raising, from Seed in Flower Garden, 211.
Plough, Chisel, 411.
Potash Deficiency Symptoms, 273.
Potassium Fertilisers, Comparison of, 604.
Potatoes, Aucklander Short Top, Virus Y-free, 133.
Potatoes, Growing, in Home and Market Gardens, 257.
Potatoes, Seed, Care of, 47.
Potato Varieties, Tahi and Rua, 218.
Potato Virus Y, Effect of, on Ilam Hardy Variety, 330.
Poultry Feeds, Experiments to Develop Test for, 397.
Poultry Industry, "Journal" Record of, 169.

Poultry, Laying, Effect of Feeding Thiram-treated Wheat to, 447.
Press, Wool, Home-made, 383.
Processed Bee Comb Foundation, 193.

Q
Quarantine, Animal, 322.
Quarantine, Plant, 191.
Quigg, J. B.—
  Agricultural Talks between U.K. and N.Z., 497.
  Feeding the World's Millions, 508.
  Livestock Numbers and Production in U.S.A., 111.
  U.K. Market for New Zealand Butter, 347.

R
Rabbits, 50 Years' War on, 145.
Races, Dairy Farm, Maintenance of, 557.
Raddling Harness, Ram, 328.
Radioactive Isotopes and Research, 329.
Ragwort Control, 285.
Ram Raddling Harness, 328.
Ranges, Electric, 313.
Ranstead Collection Given to Ruakura, 255.
Rape, Aphid Resistant, 375, 486.
Rate-of-seeding Wheat Trials in South Canterbury, 126.
Redwater in Cattle and Sheep, 517.
Research, Agricultural, 2.
Research Stations, Round the, 44, 114, 280, 328, 516, 604.
Research Work by Farm Advisory Division:
  Drainage, Cultivation, and Liming of Peat, 623.
  Improvement of Hill Country Pastures, 93.
  Lucerne-grass Mixtures, 526.
  Seasonal Variations in Pasture Irrigation, 388.
Research Work by Horticulture Division: New Types of Seed and Potting Composts, 120.
Rhubarb, Cultivation of, 130.
Richards, J. G.—Control of Sweet Brier, 339.
Rimu Sawdust in Soil Mixes, 328.
Roberts, D.—Processed Bee Comb Foundation, 193.
Roberts, Janet W.—
  Care with Insecticides, 645.
  Rooms Should Have One Focal Point, 320.
Rolling Country, Transference of Fertility on, 571.
Rooms, Focal Point of, 320.
Root Rot, Breeding Hop Varieties Tolerant to, 605.
Rotary Cutters and Weed Control, 273.
Rotomahana "Mud" Country, Animal Ill Thrift on, 546.
Rua and Tahi Potato Varieties, 218.
Ruakura Film, "Good Shepherding", 110.
Ruakura, Ranstead Collection Given to, 255.
Ruakura's 12th Conference, 106.
Ryegrass, Lamb Fattening with and without, 604.

S
St John's Wort, 19.
Salinger, J. P.—
  Cutting *Euphorbia marginata*, 639.
  Flower Garden Notes, 94, 211, 415.
Sawdust, Rimu, in Soil Mixes, 328.
Say, J. S., and Watkins, Joy—Flower Garden Notes, 527.
Say, J. S.—Flower Garden Notes, 637.
Scabby Mouth in Thar, 517.
Scotch Broom, Control of, 407.
Scott, J. D. J., Appointed Advisory Officer (Animal Husbandry), 448.
Scott, J. F.—Mole Drainage, 271.
Scott, R. H.—Use of Water from Natural Watercourses, 525.
Scrub Land, Newly Developed, Needs Heavy Topdressing, 17.
Seasonal Notes by Farm Advisory Division, 47, 143, 273, 353, 505, 557.
Seed and Potting Composts, New Types of, 120.
Seed, Clover, Inoculation and Pelleting of, 619.
Seed Crops, Grass, Nitrogen for, 47.
Seeding, Rate of, Wheat Trials in South Canterbury, 126.
Seed, Lucerne, Fungicidal Treatment of, to Control "Damp-off" Disease, 45.
Seed Potatoes, Care of, 47.
Seed, Raising Plants from, in Flower Garden, 211.
Seeds, Grass and Clover, Harvesting, 557.
Seeds, Longevity of, 115.
Seed, Vegetable, Sowing Table for September, 132.
Selenium, Control of White Muscle Disease and Ill Thrift with, 343.
Selenium Responses in Lambs, 605.
Shade House in Flower Garden, 527.
Shearing Weaned Lambs, 369.
Sheep and Cattle, Redwater in, 517.
Sheep Blowflies, Dieldrin Resistance in, 329.
Sheep Farm, Taranaki, Calves Profitably Reared on Buttermilk on, 31.
Sheep, Grazing, Nutrition of, 9.
Shennan, J. P.—50 Years' War on Rabbits, 145.
Shortridge, E. H.—Hypomagnesaemia in Beef Cattle, 559.
Silage Facilities, Better, 143.
Silage Investigations at Ruakura, 604.
Silage Stacks, Building, with Sufficient Width, 353.
Silage, Stored, Protecting, from Weather, 356.
Silver Dip, Home-made, 312.
Skim Milk, Supplementary Feed with, in Pig Feeding, 87.
Skin Damage in Bobby Calves, 7.
Skirt in Bulky Material, Waistband on, 536.
Smith, B. A. J.—
  Control of Buttercup in Dairy Pastures, 143.
  Tripod for Weighing Stock, 573.
  Winter Feed Crops for Pigs, 143.
Smith, E. G.—Spring-sown Cereals, 143.
Soil Acidity, Effect of Sulphur on, 283.
Soil Mixtures, Rimu Sawdust in, 328.
Soil Sampling in Tomato Glasshouses, 329.
Somes Island Quarantine Station, 322.
South Canterbury, Rate-of-seeding Wheat Trials in, 126.
Sow and Litter, Management of, 287.
Soya Beans, Growing of, 280.
Sporing of Facial Eczema Fungus, Field Survey on, 486.
Spray Plant, Hill Country, 443.
Springtails on Crops, Controlling, 266.
Stephen, R. C.—Fodder Beet, 273.
Stevens, A. G. W., and Taylor, C. R.—Animal Ill Thrift on Rotomahana "Mud" Country, 546.
Stockdill, S. M. J.—Bury Crop Residues to Reduce Dry Rot, 47.
Stock, Tripod for Weighing, 573.
Strain, Maud B.—
  Care of Elastic Fabrics, 636.
  Home-made Silver Dip, 312.
  Wrought Iron Furniture, 536.
Strawberries, "Black Seed" Disease of, 576.
Stuart, A., Appointed Fields Superintendent, 43.
Stuart, R. C., and Barrer, P. R.—Demonstration Farm on Banks Peninsula, 234.
Studies in Farm Management:
  A Waimarino Fat Lamb Farm, 593.
  Coromandel Hill Country Farm, 474.
Sulphur, Effect of, on Soil Acidity, 283.
Sulphur in Air and Rainfall, 328.
Superphosphate, DDT, Control of Cattle Ticks with, 331.
Supplementary Feed with Skim Milk in Pig Feeding, 87.
Swarming in Domestic Apiaries, 371.
Swedes, Boron for, 505.
Swede Seeds, Government Approved, 356.
Sweet Brier, Trials on Control of, 339.
Symons, J. L.—
  Brassica Crops for Winter Feed, 505.
  Harvesting Grass and Clover Seeds, 557.

T
Table Mats, Decorative, 432.
Tahi and Rua Potato Varieties, 218.
Taieri, Hydatid Testing Station Opened at, 85.
Taranaki Sheep Farm, Calves Profitably Reared on Buttermilk on, 31.
Taylor, C. R., and Stevens, A. G. W.—Animal Ill Thrift on Rotomahana "Mud" Country, 546.
Taylor, C. R.—Ragwort Control, 285.
Tenquist, J. D., and Lee, P. J.—Animal Quarantine, 322.
Thar, Scabby Mouth in, 517.
Thiram-treated Wheat, Effect of Feeding, to Laying Birds, 447.
Ticks, Cattle, Control of, with DDT Superphosphate, 331.
Tomatoes, Glasshouse, Developments in Growing, 459.
Tomatoes, Glasshouse, Home-made Liquid Feeds for Trickle-irrigated, 607.
Tomatoes, Glasshouse, Leaf Mould Disease in, 363.
Tomato Glasshouses, Soil Sampling in, 329.
Tomato Varieties, Outdoor, 361.
Topdresser, Jack for, 141.
Topdressing and Oversowing Tussock Country, 35.
Topdressing, Newly Developed Scrub Land Needs Heavy, 17.
Topdressing, Phosphate, Residual Effect of, 329.
Trace Elements, Role of, in Nutrition of Grazing Animals, 489.
Trickle-irrigated Glasshouse Tomatoes, Home-made Liquid Feeds for, 607.
Tripod for Weighing Stock, 573.
Tuberculosis of Farm Animals, 81.
Turkey Breeding, 293.
Turkeys, Processing and Marketing of, 377.
Turnbull, H. G., and Murdoch, A. R.—Calves Profitably Reared on Buttermilk on Taranaki Sheep Farm, 31.
Turnbull, H. H.—The Farmer and His Employees, 567.
Turnip Seeds, Government Approved, 356.
Turnips for Summer Feed, 353.
Tussock Country, Topdressing and Oversowing, 35.
Twomey, T. P. J., Appointed Technical Adviser to Dairy Products Marketing Commission, 414.

U
U.K. and N.Z. Agricultural Talks, 497.
U.K. Market for New Zealand Butter, 347.
U.S.A., Livestock Numbers and Production in, 111.

V
Vaccination, 389.
Vaccination, Control of Disease by, 72.
Vegetable Garden Notes, 37.
Vegetable Production:
  Glasshouse Tomatoes, 459.
  Outdoor Tomato Varieties, 361.
  Potatoes, 257.
  Rhubarb, 130.
Virus Y-free Aucklander Short Top Potatoes, 133.
Virus Y, Potato, Effect of, on Ilam Hardy Variety, 330.

W
Waikato, Lucerne in the, 114.
Waimarino Fat Lamb Farm, 593.
Waistband on Skirt in Bulky Material, 536.
Wallace, L. R.—
  Nutrition of Grazing Sheep, 9.
  Shearing Weaned Lambs, 369.
Walsh, R. S.—Anti-granulation Method for Honey Packers, 229.
Warren, R. G.—
  Electric Fences on Hill Country, 356.
  Potash Deficiency Symptoms, 273.
Watercourses, Natural, Use of Water from, 525.
Water Heater, Dairy, Buying a, 592.
Watkins, Joy, and Say, J. S.—Flower Garden Notes, 527.
Watkins, Joy—Flower Garden Notes, 99, 215, 301, 419, 533, 641.
Watt, J. H., Appointed Horticultural Superintendent, 336.
Weaned Lambs, Shearing, 369.
Webster, A. B., and Boyce, W. R.—Home-made Liquid Feeds for Trickle-irrigated Glasshouse Tomatoes, 607.
Webster, A. B.—
  Celery Varieties Treated with Gibberellic Acid, 575.
  New Types of Seed and Potting Composts, 120.
Weed Control, Chemical, in Cereals, 273.
Weed Control Conference, Thirteenth, 225.
Weed Control Experiments at Rukuhia, 516.
Weed Control in Lucerne, 141.
Weed Control in Pastures, 47.
Weed Control in Peas, 353.
Weed Control in Wheat, 517.
Weed Control, Rotary Cutters and, 273.
Weed Identification and Control:
  Black Nightshade, 121.
  Pennisetum macrourum, 337.
  St John's Wort, 19.
Weed Pests, Biological Control of, 517.
Weeds, Chemical Control of, in Annual Crops, 405.
Weevil Damage in Young Brassica Crops, Preventing, 557.
West Coast, Land Development on, 434.
Wheat, Thiram-treated, Effect of Feeding, to Laying Birds, 447.
Wheat Trials, Rate-of-seeding, in South Canterbury, 126.
Wheat, Weed Control in, 517.
White Muscle Disease and Ill Thrift, Control of, with Selenium, 343.
Wickenden, G. L.—
  Handy Dog Chain, 570.
  Home-made Wool Press, 383.
Wild Pigs, War on, 155.
Wilt-resistant Onward Peas, 565.
Wool Press, Home-made, 383.
Wrinkly Skin Disease of Cattle, 45.
Wrought Iron Furniture, 536.

Y
Yen, D. E., and Casey, R. J.—Wilt-resistant Onward Peas, 565.

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